In This Issue *Papers and Discussions of the forthcoming Convention of the Northwest Electric Light and Power Association at Spokane*

JOURNAL OF ELECTRICITY

VOL. XXXIX NO. 6 SAN FRANCISCO, SEPTEMBER 15, 1917 PER COPY, 25 CENTS

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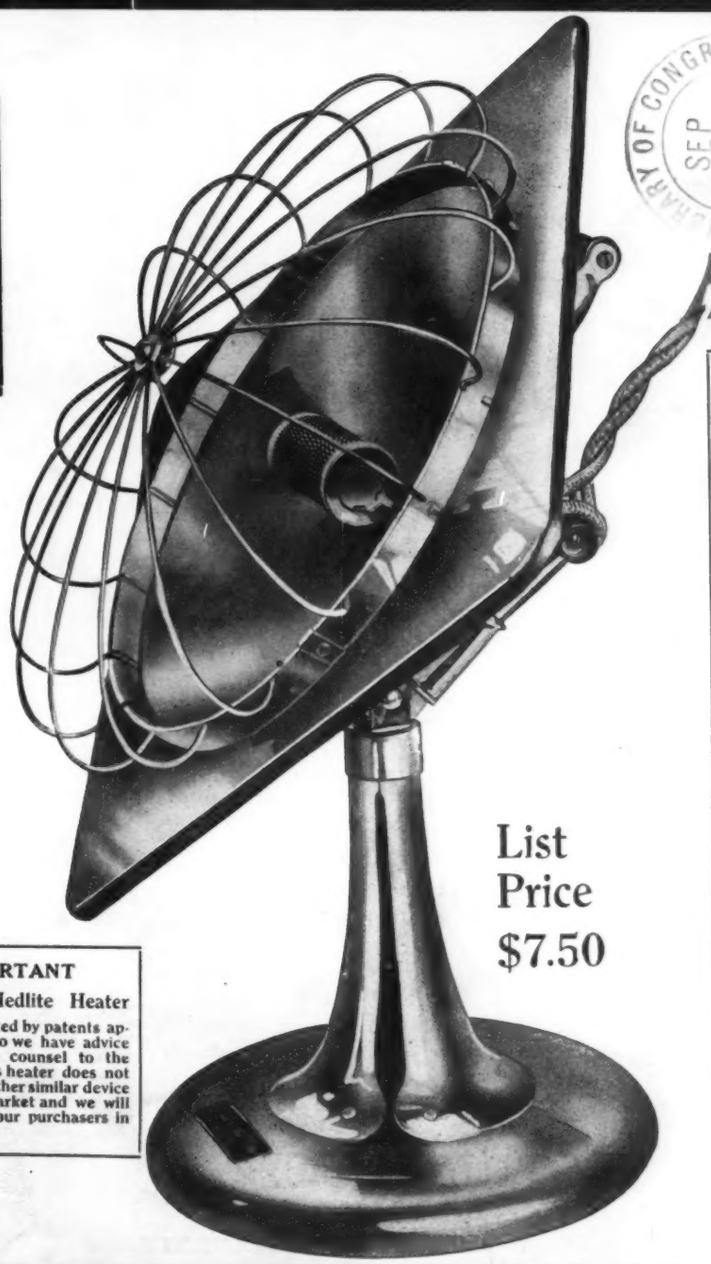

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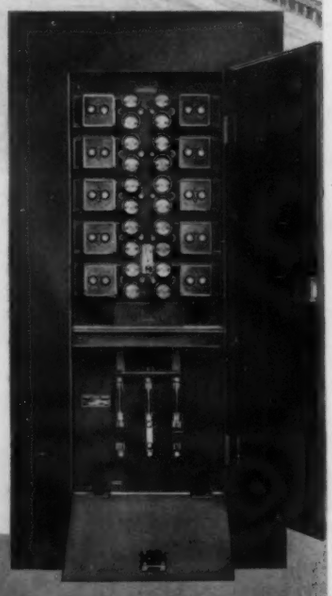

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JOURNAL OF ELECTRICITY

Devoted to the Generation, Distribution and Utilization of Energy

VOLUME XXXIX SAN FRANCISCO, SEPTEMBER 15, 1917 NUMBER 6

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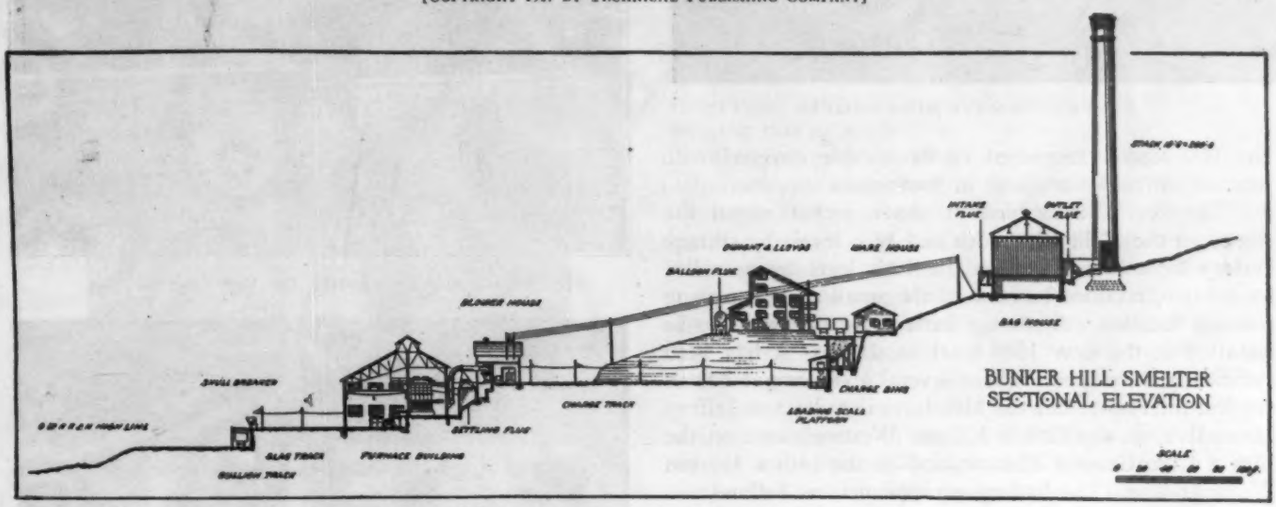
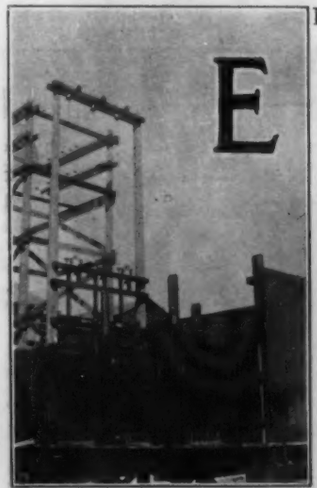


Sectional Elevation of Bunker Hill Smelter

ELECTRICITY AT THE BUNKER HILL & SULLIVAN

BY A. H. HALLORAN

(The Bunker Hill and Sullivan mine, mill and new smelter at Kellogg, Idaho, is an excellent illustration of the application of electric power to mining in general and the metallurgy of lead in particular. As electricity is fast becoming indispensible in the mining industry, it behooves electrical men to understand the various metal mining processes. Furthermore, as the Bunker Hill installation is to be the objective of the Northwest Electric Light & Power Association's convention excursion in September a description of the properties seems at once timely and instructive.—The Editor.)

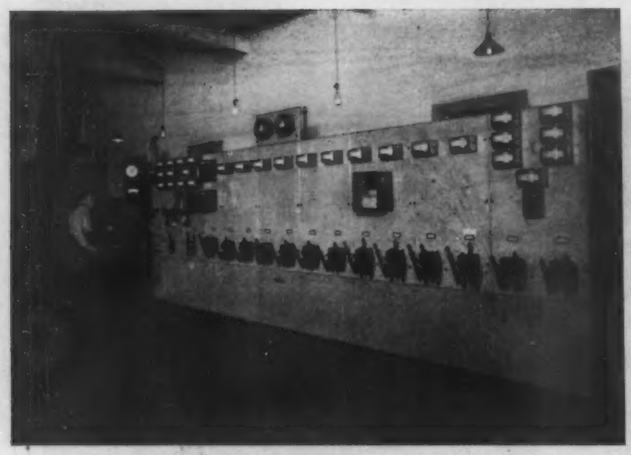


Receiving Outdoor Substation

ELECTRIC power for the operation of the entire plant is purchased from the Washington Water Power Company, whose 60,000 volt transmission lines from Spokane serve the Bunker Hill substation where seven 650 k.v.a. transformers step the current down to 2300 volts for distribution over the local lines. The mining company has installed a 750 h.p. steam turbine driving a 2300 volt generator as a standby for possible interruptions to the hydro-electric service, which, by the way, have been remarkably infrequent. A turbine is also being installed at the smelter. Either of these turbines can be started and carry the main load within seven minutes after power is shut off.

In the mine, electric power is used for hoisting, traction and pumping. The mine is reached through the Kellogg tunnel, whose outlet is near the mill and whose face cuts the shaft at the 9th level, two miles distant. Here an electric hoist brings the ore from the various lower levels and dumps it into bins, whence it is drawn into cars for haulage by 500 volt trolley locomotives to the mill. From the main Bunker Hill shaft the Kellogg tunnel and trolley system also radiates 4500 ft. to the Sierra Nevada Cons. shaft and 4500 ft. to the Caledonia shaft.

Direct current for operating the trolley system is carried on No. 00 copper wire as far as the Bunker Hill shaft and on No. 0 copper to the other two shafts. Alternating current for the pumps, hoist, storage battery motor-generating sets, shaft and station lighting, and air-preheaters in compressed air hoist, is transmitted at 2300 volts over two circuits, a No. 2 B. & S. triple conductor, varnished cable incased in a lead sheath and a



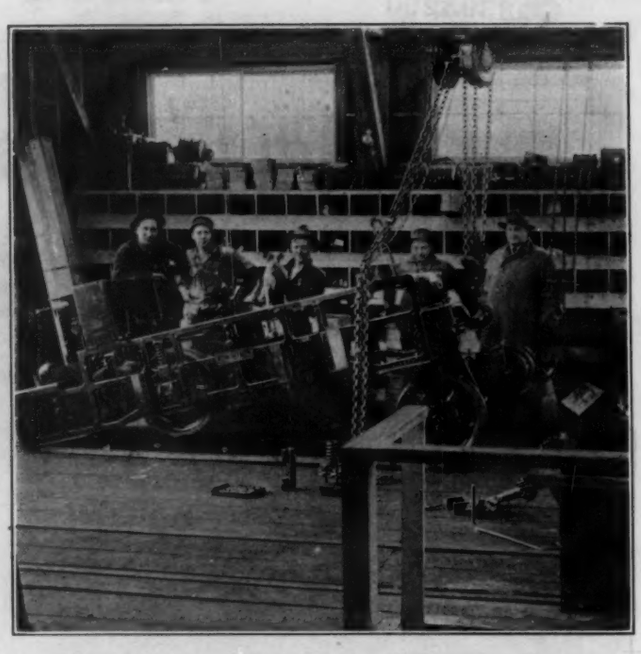
A.C. Switchboard in Mill Substation

No. 000 leaded varnished cambric cable covered with jute. Both cables are kept in continuous service.

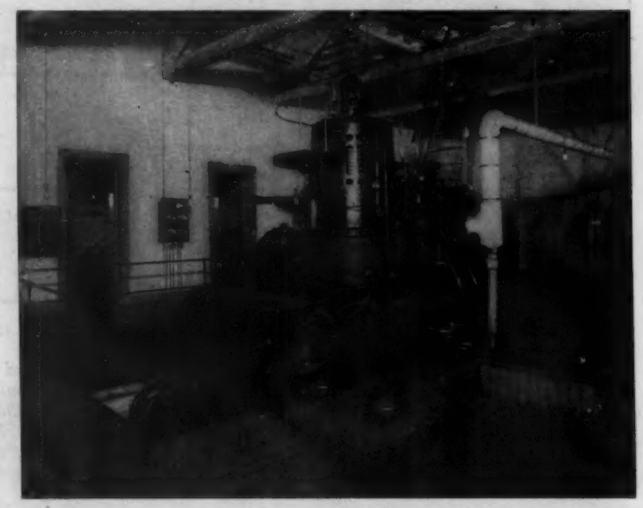
The ore is assembled at shaft pockets from the stopes on the 11th, 12th, 13th and 14th levels by storage battery locomotives and on the 10th level by a trolley locomotive, retained because of the small and decreasing tonnage handled. A storage battery locomotive is to be installed at the new 15th level as soon as it has been sufficiently developed. These several levels are at 200 ft. vertical intervals. On the 11th level is a 2½ ton Jeffrey locomotive, on the 12th a 3½ ton Westinghouse, on the 13th a 4 ton General Electric, and on the 14th a 4½ ton Westinghouse. The battery equipment is as follows:

2½ ton Jeffrey—63 cells, type "A 8" Edison—Capacity 150 ampere hours.
3½ ton Westinghouse—70 cells, type "A 8" Edison—Capacity 300 ampere hours.
4 ton General Electric—70 cells, type "A 8 Edison—Capacity 300 ampere hours.
4½ ton Westinghouse—66 cells, type "A 8" Edison—Capacity 300 ampere hours.

Charging stations at all levels are supplied from a 50 h.p. motor-generator on the 13th level receiving 2200 volt current from the a.c. three-phase line and delivering 125 volt d.c. A wattmeter on the a.c. side records kilowatt hours consumed. Overload circuit breakers and reverse current relay protect the motor-generator set from



Storage Battery Locomotive for Underground Use



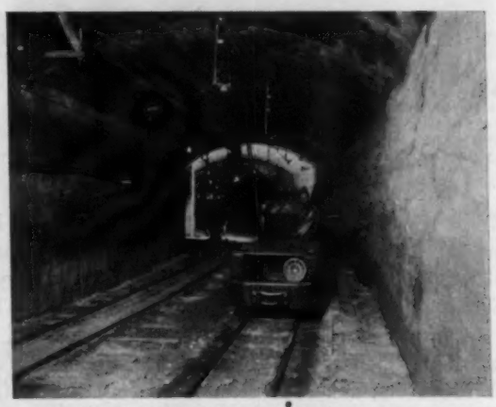
Emergency 750 kw. Curtis Steam Turbine

Motor Generator Set Furnishing 500 Volt Direct Current for Locomotives in Tunnel

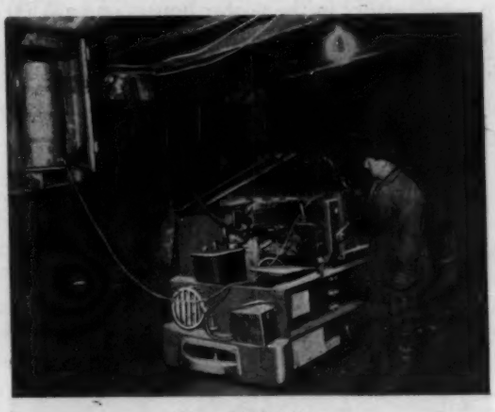
Seven 650 k.v.a. 60,000/2300 Volt Transformers in Mill Substation

Loading Ore Cars in Mines

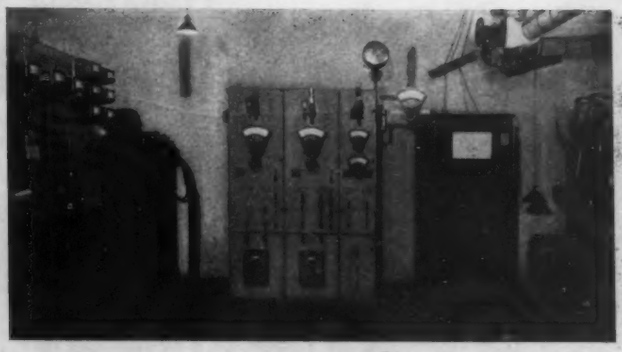
Underground Charging of Storage Battery Locomotives



Trolley Locomotives and Train of Ore Cars



Tunnel Lighting



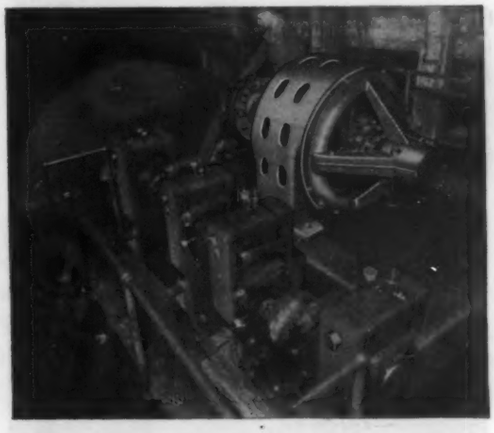
D.C Substation at Mill

overload and possible reversal of current due to low voltage or service interruption. Each charging station is equipped with regulating rheostats so as to vary the charging rate as needed.

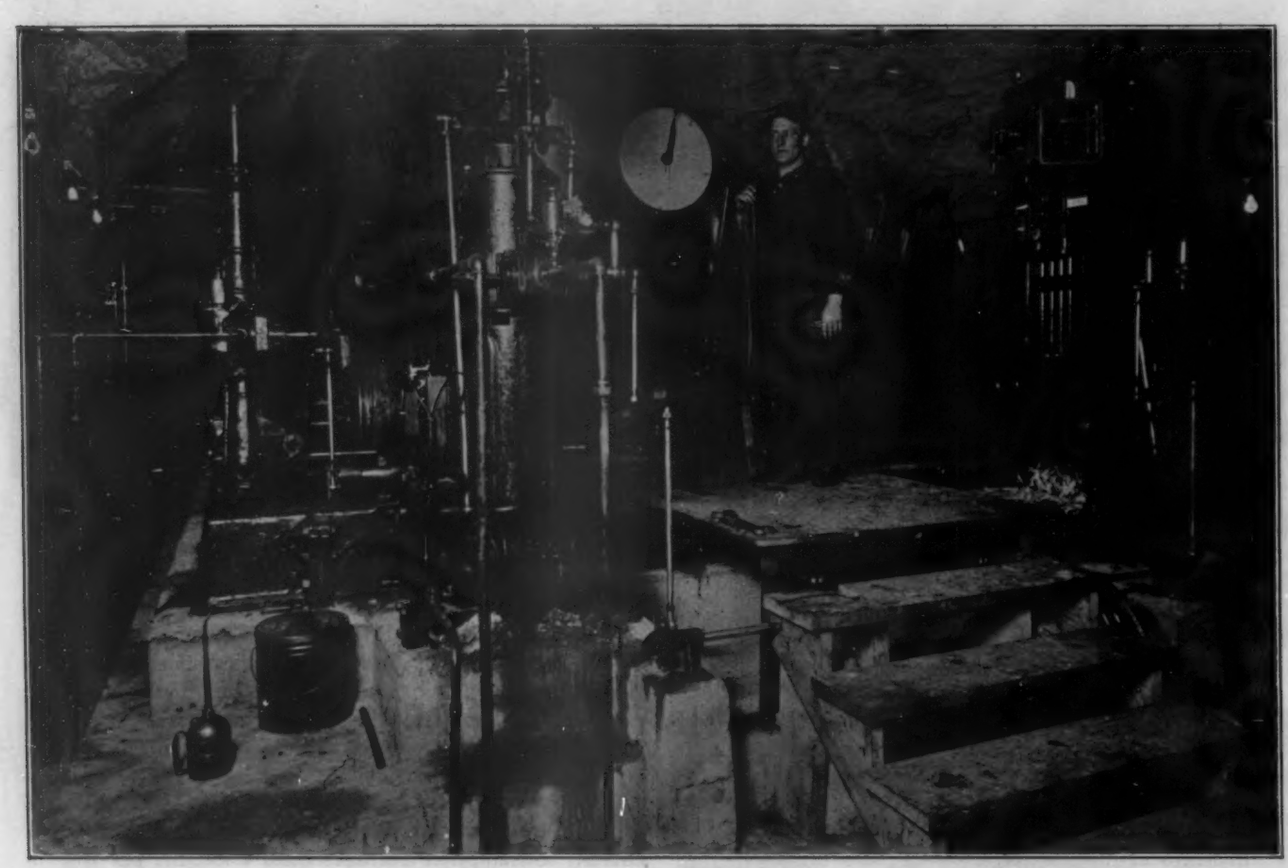
The Jeffrey locomotive is equipped with two sets of batteries, one being charged while the other is in use. The other locomotives, starting with full charge, are operated from 8 a.m. till noon, when they are given a 30 minute charge. After four hours further operation they are given a two hour charge which suffices for an eight hour operation, after which they are given a five hour charge and then stand idle for 30 minutes, thus completing the 24 hour cycle.

Each locomotive handles an average of eight 3 ton cars per train over an average distance of 1000 ft. The current consumption averages 0.2474 kw.-hr. per ton of ore hauled, which figure also includes the handling of an unknown tonnage of waste. It is estimated that storage battery operation costs 75 per cent less than trolley locomotives doing the same work. Distilled water for the batteries is brought into the mine daily in 5 gal. canvas water bags.

The ore is hoisted to the Kellogg tunnel by a double drum hoist driven by an induction motor with automatic acceleration provided by a Cutler-Hammer switchboard controller of the multiple solenoid type. The engineer merely throws his controller to the running position to start the hoist, the amount of current and acceleration being controlled by the board through a series of contactors controlled by series relays. A chart record in the power house gives a complete history of all hoisting



150 h.p., 2300 Volt Motor Driving Quintriplex Motor on 13th Level



Underground Electric Hoist

operations. During 1916 there were 416,689 tons of ore hoisted at a cost of $22,751.84, as follows:

	Total for the year	Average per ton
Wages of hoist men and ship men	12,104.00	.029
Lubricants	315.11	.001
Timber and lagging	12.22	....
Miscellaneous	4,595.45	.011
Machine shop repairs	1,857.87	.004
Electrical repairs	697.15	.002
Electric power	3,094.84	.007
Electric light	75.20	....
	$22,751.84	.047

Water is pumped from the shaft at an average daily rate of nearly 600,000 gal. by five motor-driven pumps aggregating 535 h.p., the motors being three-phase, 2200 volt. A General Electric curve drawing ammeter in each circuit records the time of starting and stopping and the amount of power consumed. The pumping costs for 1916 were $15,356.24 as follows:

	Total for the year	Average per ton hoisted
Wages of pumpmen	$4,859.50	.012
Lubricants	77.79	....
Miscellaneous supplies	896.41	.002
Machine shop repairs	1,452.25	.003
Electrical repairs	412.72	.001
Electric power	1,657.57	.019
	$15,356.24	.037

Minor electrical equipment in the mine includes lighting the tunnel, shaft and stations, a complete underground telephone system equipped with an auxiliary 110 volt circuit operating Russell signal horns, and a block signal system manually operated. All hoist bells, with auxiliary lamp flashers and all telephone signals, are operated at 110 volts, a.c. An electric "safety first" sign is installed in the tunnel.

Air for the rock drills is furnished at 100 lb. pressure by two compressors in the power house, one a 3300 cu. ft. Nordberg, driven by a steam engine on one end and a 500 h.p. turbine water wheel on the other, and the other

Underground Telephone

Electric "Safety First" Sign in Tunnel

400 h.p., 2200 Volt Induction Motor Driving 2400 cu. ft. Ingersoll-Rand Air Compressor

a 2400 cu. ft. Ingersoll Rand driven by a 400 h.p. induction motor.

The ore is trammed from the shaft to the mill through the Kellogg tunnel by 500 volt trolley locomotives in 17 car trains, each car having a capacity of 3¼ tons. Eighteen of these are in service for hauling ore, timbers, men, mine supplies and fuel for the power plant.

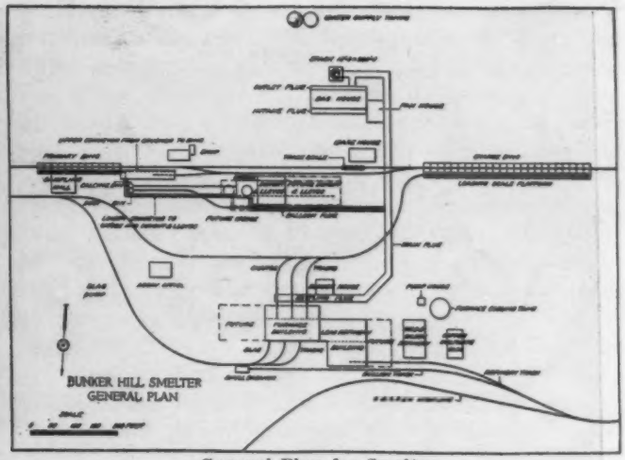
The crushing and concentration of the ore represents the largest single factor in the use of electric power,

Ore Cars at Dumping Bin

the 33 motors in the rock house and two mills constituting a connected load of 1897 h.p. The treatment includes crushing, coarse concentrating, fine concentrating and flotation.

The ore cars are dumped into a 1400 ton storage bin whence a belt conveyor carries it to No. 5 bronze ball crushers. Over the belt conveyor at the grizzly entrance to the crusher is a 36 in., 250 volt electromagnet which picks out any iron or steel that may be mixed with the ore. This not only prevents damage to the crushers and rolls, but also saves tools which have been lost in the mine.

From the ball mills the ore passes through trommels to a Symons disc crusher, whence it passes through another set of trommels to a 1700 ton ore bin. As the two concentrating mills, West No. 1 and West No. 2, are nearly identical, the accompanying flow sheet of the latter will suffice to trace the treatment. The vanner and table floors in the coarse concentrating section are driven by a 250 h.p. motor and the jigs and rolls by a 200 h.p. motor.



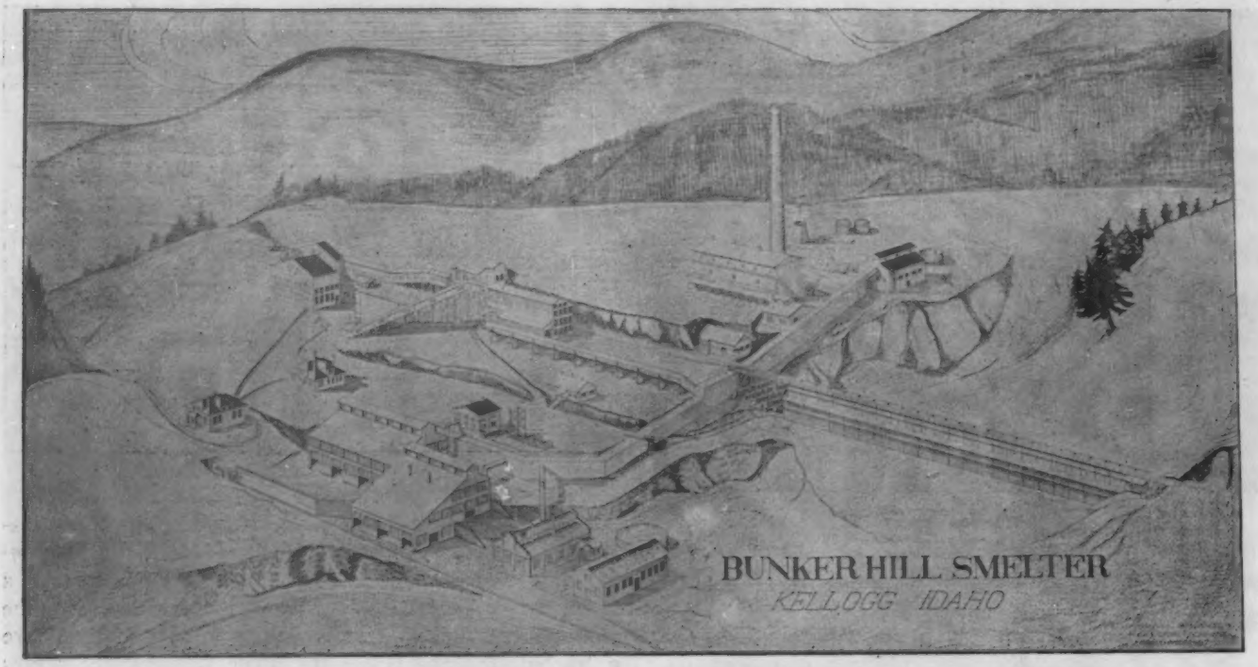
General Plan for Smelter

Briefly described, the process consists in the separation of the coarse concentrates by 7 Harz jigs, the regrinding of middlings in rolls and mills so as to pass a 20 mesh screen for fine concentration together with the slimes from the jigs. The values in this material are extracted by Card tables and Frue vanners, the slimes passing to flotation cells, where after mixture with oil and agitation with air the froth is floated off, the surplus water removed in a Dorr thickener and an Oliver filter press and the concentrates collected in bins whence they are hauled in cars to the smelter.

Electro-Magnetic Extractor of Iron in Ore

250 h.p. Induction Motor Operating Table and Vanner Floor

The new Bunker Hill smelter, as blown in during August, 1917, is designed to treat not only the concentrates from the Bunker Hill & Sullivan mines, but also other lead-silver mines in the district. It comprises a complete equipment for sampling, roasting, sintering, smelting and refining gold, silver and lead ores. An electrolytic zinc plant is also to be installed in the near

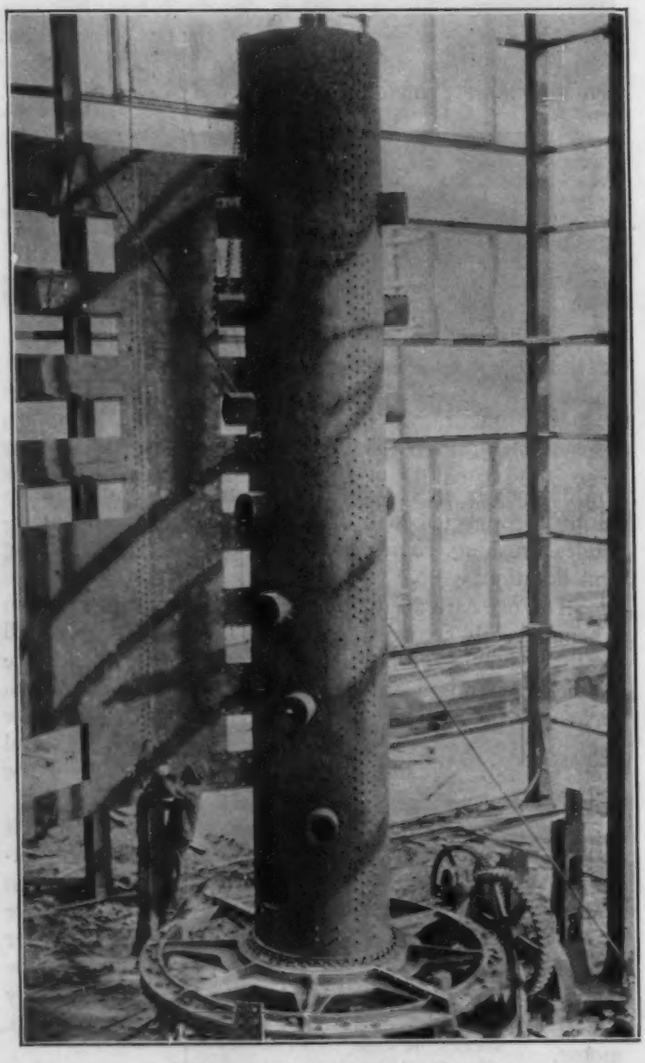


New Bunker Hill Smelter

future. The 30 acre site is less than a mile to the west of the mill, with which it is connected by a standard gauge railroad which delivers the ore and concentrates to concrete receiving bins.

From the receiving bins belt conveyors remove the ore to a crusher and sampler having a daily capacity of 1200 tons of ore. Here a 75 h.p., 2200 volt motor drives a 10x20 in. Blake crusher, two sets of 36x14 in. rolls, a 48x72 in. trommel and four Vezin samplers. Four 5 h.p., 440 volt motors operate the conveyor system which then distributes the ore to any one of eight storage bins, each

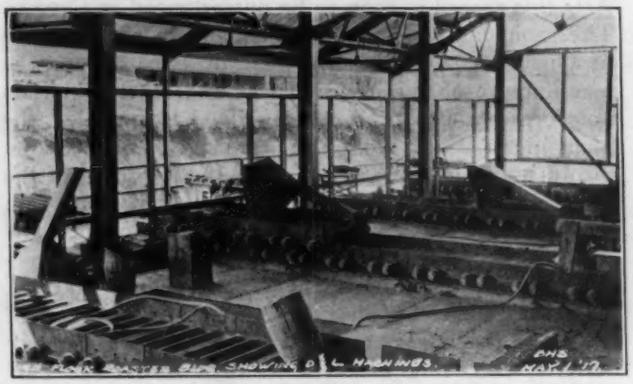
Scale Hoppers



Erection of Wedge Roasting Furnace

equipped with two apron-belt feeders delivering the ore to a belt conveyor going to the roaster building.

Here a multiple deck 26 ft. Wedge roasting furnace with a capacity of 50 tons per day gives a preliminary roast to lead matte or other material carrying a high percentage of sulphur. This furnace consists essentially of a cylindrical shell surrounding a series of compartments staggered one above the other so that the ore drops from one to the other as it is raked by a series of



Dwight & Lloyd Sintering Machine

arms actuated by a central shaft revolved by a 5 h.p. motor. Fuel oil and the sulphur in the ore furnish sufficient heat to remove most of the sulphur. As the gases carry off some values in the form of flue dust a Cottrell electrostatic precipitatation system is installed to catch the dust from the Wedge furnace as well as the sintering machines.

The roasted material from the Wedge furnace, together with concentrates carrying a lower sulphur content, are delivered by belt conveyors to storage hoppers which feed four Dwight & Lloyd desulphurizing and sintering machines. By means of these machines a thin sheet of intense flame impinges directly upon a thin bed of ore as it is carried forward on an endless steel belt, motor driven. This belt is perforated so that the hot gases are drawn through the ore by large exhaust fans which thus remove the sulphur as sulphur dioxide and sinters the ore into a compact mass. Each steel belt is driven by an induction motor and each exhaust fan by a 50 h.p., 2200 volt motor.

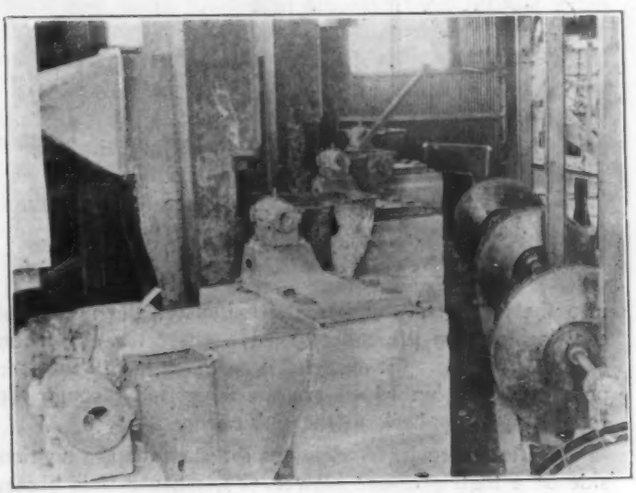
The roasted sinter is carried in hopper bottom steel cars to eight 3400 ton reinforced concrete storage bins. An equal number of timber bins of the same capacity hold both the coke and the limestone, crude ore, slag, by-products, etc., which are used in making up the charge for the blast furnace. Each bin is equipped with two arc gates and 4 ton hopper scales, where the material is weighed and delivered in bedded layers to hopper bottom charge cars that discharge directly into the blast furnaces, being hauled by 4 ton trolley locomotives.

The blast furnaces are three in number, each 42 by 180 in. at the tuyeres, with an estimated capacity of 200 tons of ore per day. Each furnace has twenty 4 in. tuyeres through which air is blown at 15 lb. pressure by motor driven compressors in the power house. After the slag has been drawn off into steel pot cars handled by an electric locomotive, the bullion is delivered to lead pots which are carried by a 20 ton, 4 motor electric crane to the drossing and refining department.

Here the antimony, arsenic and copper are recovered from the bullion in two 80 ton softening furnaces, the bullion then passing to four 50 ton desilverizing kettles. Zinc is now added so that the gold and silver will unite with it as a dross which is skimmed off for further treatment. The lead, in turn, passes to two 80 ton refining furnaces and thence to four 50 ton merchant kettles, whence it is removed in molten form by four centrifugal pumps which deliver it to the casting machine. This machine, the invention of John F. Miller, consists essentially of a water cooled drum whose outer surface carries a series of moulds. Fitting tightly over the upper portion of the drum is a metal jacket fitted with a discharge pipe from the lead pumps. As the drum is revolved by an induction motor, the moulds are successively filled, the lead pigs dropping onto a truck beneath for delivery to freight cars.

In the silver refinery the zinc is first retorted off from the dross in eight Faber du Faur furnaces and the residue treated in two cupelling furnaces where the lead is removed as an oxide, leaving the gold and silver as dore metal. With the addition of sulphuric acid the silver is removed as silver sulphide and the gold left as a residue, which is cast into bricks in a crucible furnace. The silver is siphoned into the lead-lined tanks, copper added to form copper sulphate and precipitate cement silver, which is washed and melted for casting into bars. The copper sulphite solution is evaporated and bluestone recovered.

The gases from the Wedge roasting furnace and the Dwight & Lloyd machines pass through 400 ft. of steel balloon flue to Cottrell precipitation tubes having a capacity of 60,000 cu. ft. of gas per minute. From here, these gases, together with those from the blast furnaces, pass through a bag house to collect the fumes. This is a



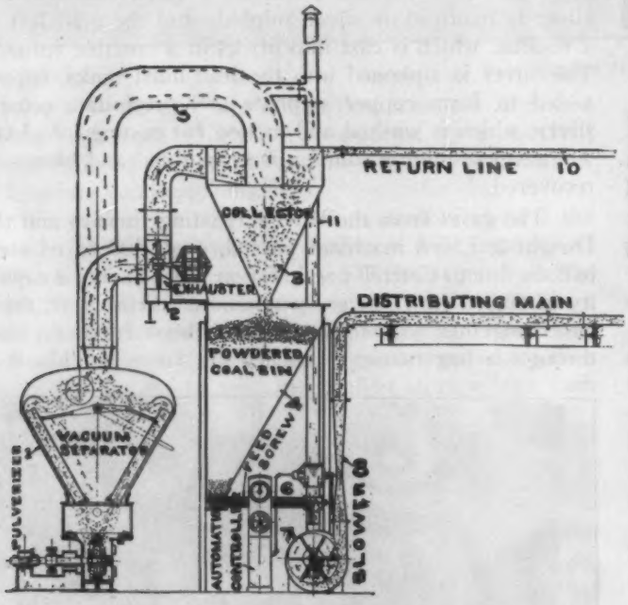
Assembly of Fans for D. & L. Machines

concrete-steel building, 56 by 100 ft., divided into three chambers, each containing 400 bags. Beneath these bags is a thimble floor through which the dust is dropped into twelve cells from which it is removed from time to time. A centrifugal fan having a capacity of 60,000 cu. ft. of air per minute and driven by a 75 h.p. motor forces the fumes through the bag house. A similar fan is held in reserve. All the gases are finally delivered to a Custrodis brick chimney, 15 ft. internal diameter and 200 ft. high.

In the smelter power house two Ingersoll-Rand turbo-blowers, each with a capacity of 12,000 cu. ft. of free air per minute, furnish air at 48 oz. pressure to the blast furnace tuyeres. Each blower is geared to a 200 h.p. General Electric induction motor. There are also two 75 kw. motor-generator sets supplying direct current to the trolley locomotives and electric cranes.

The smelter was designed to use fuel oil in the roasting, sintering and blast furnaces. But recent advances in oil prices have necessitated the installation of a coal pulverizing plant which will supply powdered coal in lieu of fuel oil. This is accomplished by means of the Holbeck system, manufactured by The Bonnot Company of Canton, Ohio.

By this system slack coal is drawn from storage bins and automatically fed to a pulverizer where it is ground to dust. As may be seen in the accompanying drawing, the action of the pulverizer throws the dust into a vacuum separator, whence the finest particles are drawn into the exhauster (2) and the coarse fall back



Coal Pulverizing System

into the pulverizer. From the exhauster the powdered coal is blown to the collector (3), where the expansion of the air permits the suspended particles to fall into the powdered coal bin (4). The air is carried through the return pipe (5) back to the pulverizer.

A feed screw (6) delivers the dust to the suction side of a high pressure blower (7), whence it is blown into the distributing main and carried to the furnaces. The coal which is not used in the furnaces passes through the return line (10) to the collector and powdered coal bin, the excess air passing to the suction side of the blower through pipe (11).

In conclusion, the writer wishes to express his indebtedness to Walter C. Clark, electrical engineer, Bunker Hill & Sullivan Mining Company, and M. J. Bottinelli, his assistant, for information furnished and courtesies extended.

A NEW RECORD FOR POWER TRANSMISSION

For many years engineers of the West have prided themselves in the world beating engineering feat at Carquinez Straits in California, where the Pacific Gas & Electric Company transmits a portion of its great hydroelectric energy from its water power plants in the high Sierras by means of four steel cables with a 4427 ft. span of wire.

According to the Journal of the Royal Society of Arts this record is soon to be outdistanced in Canada. The rapid increase in power demand in the province of Quebec during the last year or two, due to the manufacture of munitions of war and other materials not formerly produced in Canada, has impelled the Shawinigan Water & Power Company to undertake a record-breaking engineering feat—the spanning of the St. Lawrence River with a 100,000 volt transmission line, furnishing power and light to various towns. The construction of this transmission line entails the erection of two towers, which will support a 5000 ft. span of three steel cables. This span is the longest of the kind known, says the Journal of the Royal Society of Arts, exceeding the 4427 ft. span across the Carquinez Straits in California.

Towers will be necessary rising to the unusual height of 350 ft., the same elevation as the top of the Quebec Bridge. The height of the towers is fixed by the requirement of river navigation, the lowest point in the cable having to clear the water by 160 ft. minimum. The towers rest on concrete foundations located in the river about 500 ft. from each shore. These foundations consist of four circular concrete columns 11 ft. in diameter, extending to a depth of 40 ft. below the river bed and projecting 25 ft. above it, thus being partly submerged.

At the top the towers widen out into a platform, on which are mounted the supports for the three cables, which are to be of plow steel. These cable supports are all on the same elevation and placed in such a position as to keep the cables 50 ft. apart, to prevent them from swinging together in the long span. The cables are not anchored at the supports, but are brought down on the back of the towers to an anchor in the ground at some distance behind the towers. The supports, however, are designed to allow a certain amount of movement to the cables, due to the expansion caused by changes in temperature.

In order to use the cables as conductors to carry current at 100,000 volts, it will be necessary to insert special insulators in them between the ground and the supports on the towers. The magnitude of this problem is better understood when it is realized that these insulators are not only subjected to extreme electric tension, but also to a mechanical stress of above 150,000 pounds each. The arrangement of insulators must allow the replacement of any parts that may become damaged through electric failure without interfering with the mechanical safety of the span. The insulator group will consist of an elaborate arrangement of porcelain units of a new type subjected to pressure only, and held together by an iron frame. It is hoped to have the whole project completed by the end of the summer.

SOME APHORISMS OF THE TRADE

BY J. C. RALSTON

(Pithy statements of a general truth, in a language that men of the electrical industry can understand, are of great value in instilling enthusiasm and forwarding the industry as a whole to a higher plane of usefulness. Here are some aphorisms that should readily appeal to men of the electrical industry in the West. The author is a consulting engineer of Spokane and has prepared this paper for presentation at the Spokane convention of the Northwest Electric Light and Power Association, September 12-15, 1917.—The Editor.)

Observation, imagination and technique are the three phase delta connections that lead to heaven. They are the mystic trinity in the electrification of humanity, lacking which the science, the business and the trade must incessantly lag; possessing which your activities may speed to the ultimate terminal. Combine them, and you distill the sparkling wine of success; dissociate them, and you compound the gall of failure; omit them, and you de-energize your supremest talents.

Their combination, in the midst of these martial days, has made, with rare vision, this convention an inspiring reality.

It is impossible to conceive a permanent success in light and power in which any one of these three principles is wholly absent. Observation without imagination merely confirms the obvious; imagination without observation evaporates into nonsense, while both of them devoid of technique condense into moonlight mist. Finally, that which makes for your industry's greatest attainments is when the three are connected in series, proportional in energy, periodicity and performance.

If one were speaking of the historical development of light and power, one might say that these three doctrines correspond in sequence to the infancy, adolescence and maturity of the industry. In infancy, from Franklin's kite-string to the long-distance circuit, the observation of outstanding phenomena dazzled even the wondering eyes of the wise men. In adolescence, imagination, bridled, on the one hand, with the conservative hopes of genius, led to the unfolding of the dynamic mysteries of electricity; and, on the other, untrammeled by the rules of reason, led, through the medium of profane literature, into the weird, uncertain and extravagant fields of popular expectation. The third period, now surely opening, reveals this industry of the Magi—this supernal enchantment—of which you gentlemen are the high priests, standing on the golden threshold of virile, resourceful and promising maturity.

But philosophic history always diverts us into the fields of comparative speculation—the calibrating of past achievement,—too often pedantic, too seldom empiric. Perhaps, then, our theme, like the heavenly muse, should suggest the inspiration of immediate accomplishment, or the power of ambition, or the futility of a handicap in the hands of high resolve, or the laudable purpose of achieving not the greatest thing in our work but the best.

Thus, observation leads us to ask, What's in a name? Well, so powerful, so subtle, so tragic is this question that we find history has recorded but a single instance of a child being named Judas Iscariot. A name may be a nonentity, like a forgotten grave. It may be a millstone suspended by the cords of tradition to the neck of foolish immolation; or it may be an irreplaceable jewel, the gift of mortal time and man's devotion to service.

The public service corporation which through a lack of imagination has gained a reputation for aloofness, has thereby hung a millstone on the neck of its stockholders. If, like a Shylock, it has mercilessly demanded its pound of flesh, it has failed in the observation of those outfield conditions which lead to the boneyard. If, through the absence of technique, it has given an unwilling, inadequate and desultory service, a certificate of necessity will haunt its morbid dreams.

All plans are not made on a drafting board. A well defined purpose, carefully drawn to scale, and fitting into the needs of your company, makes a beautiful drawing. Blue print it, and keep a copy on your desk and one at home. It will keep you from being empty-hearted.

Because you demand 100 cents on the dollar in your pay check is the honorable and imperative reason why you should give 60 minutes on the hour in the personal or company services which you sell. This is the exciter bus of honesty.

Check your opinions by your actions. Such a course will cure more bad politics, more poor judgment and more visionary projects than all the rules of psychology. It is a sort of synchronizer, and keeps one in step with effective methods.

No patience is tolerable with the man who sighs that he has been denied the opportunity of education. That's the slacker's groan. The power of ambition can chisel a perfect model from the most adamantine human granite. This is equally true in the midst of our most exacting employments. Under the inspiration of this very power we achieve the best within us. It is the e.m.f. of panting ambition, and this is what your company and your customer pays for.

A grouch in the commercial office is like a stray current, one never knows where it may do damage; but a smile is like a static arrester, it chokes the bile out of a customer's kicks. The grouch is a liability, always depressing the balance sheet; the smile is an asset that swells the dividends. Cultivate the habit of smiling, then convert the habit into a gift.

The chief who always atrophies his assistants by austerity, who wears a Medusa on his shield, is the man that usually freezes up his customers. Take the resistance coils out of his gizzard. But the genial, sympathetic and whole-hearted chap who can keep abreast of his current technical literature, who knows why the other chap is succeeding, who is always qualifying for the place ahead, whose keen observation,

lively imagination and finished technique are invariably kept at hot-spot temperature, is the one who imparts a fly-wheel effect to the entire staff.

The company that administers its policies of public intimacy at long distance is like a blind traveler,—sure of nothing so much as pitfalls. If every management had always applied the single-phase sytsem of consideration to both the stockholder and the customer, instead of an alternating two phase method, doubtless the dividend graph would show fewer depressions. Your customer must profit if your company would profit. This is the law of simple harmonic motion.

All public service agencies are of necessity concerned with politics, because politics concerns itself with such agencies. This is an inescapable, but sometimes poorly visioned, corollary. Mutual and friendly concern are often displaced with mutual and cordial distrust, forced upon us by vested authority and accepted by invested prudence. Worse still, the politicians have dug themselves in, and have woven their theories of Industrial Democracy into a maze of threatening entanglements. Thus interests which would willingly acknowledge rational regulation are driven to accept in addition an irrational overlordship which, unhappily, is at once petulant and paradoxical.

Being full of knowledge, knowing not only the intricacies of your business, its history, its philosophy and its economics, as well as its relation to the scheme of public welfare, you are the ones to translate its significance, its purpose and its necessities into public interpretation. The necessities of the public are the law, and you are the true prophets thereof.

False prophets there are a-plenty, in office and out, and a goodly number of stuffed ones besides. Workers they are by day and toilers by night, with a full load factor and no limit on over-heating. They are ever ready to throw their theoried monkey wrench into the gears of commerce. Put a safety guard over your gears by becoming more active men of affairs and by identifying your leisure moments with public well-being.

Your interests are the media which state legislatures and federal bureaus so often use for the culture of socialistic experiments in their visions of an industrial Utopia. Business men generally and public utility officials particularly might well take a more active interest, openly and frankly, in politics. It is an honorable privilege as well as a civic duty. They should know their political candidates as well as they know their foremen. These federal and state agencies combine to form an active anode, as it were. The apathetic public is always the inert but chargeable cathode, while the resultant electrolytic deposit is the supertax of strangulation and the price of senseless indifference.

Your combined observation should surely give wings to a prophetic and clear-visioned imagination that must discern a depressing future unless, with the technique of your masterful minds, you divert these threatening schisms back into the orthodoxy of governmental encouragement. The proposed encroachments of the Bureau of Standards, for instance, are outstanding questions whereof imagination needs no lotus compound to conjure up the Fool's Paradise into which, if submissive, you may be led. But it is sure that under a firm resolve, with patience and perception, with team work and a common policy, the genius of your intelligence will prove these handicaps to be of no avail. "Doing easily what others find difficult is talent; doing what is impossible for talent is genius"

All lines of organized activity at times have to face the unexpected, have to solve strange and peculiar problems, meet climateric emergencies, and repair all sorts of broken circuits. Sometimes these surges are political, frequently they are financial, often they are technical; relatively they are unexpected, but sequentially they are deliberate. Therefore, the man of imagination is the one who can anticipate a crisis,—he gets there first.

Today the government is sending its trade commissions and special commercial agents across the seven seas in quest of information and reports,—a laudable policy, to be sure; but let us ask why does not Industry demand laws by which business may combine, as in other nations? It could then send out its own agents, not to make findings and reports, but to bring home orders. Every power company should be politically and certainly is commercially concerned. Industries not Utilities hold the golden fleece. Continuing industrial contracts make corporation finance read like the stories of mythology,—triumphant gods and demi-gods.

It might be profitable to know what reactance effect there would be on the growing pains of public utility concerns if their securities were popularized through small denominations and were made legal media for investment by savings banks. Liberty bonds have given the whole people their first vision. Your industry might well and shrewdly have more partners among the common people. It would expand the sales department and put hundreds of good-will agents in the field. The small, omni-present politician and the restless public hate nothing so much as that which they believe to be a close corporation. There is a destructive imagination—delete it. Yours must be a constructive one—consecrate it.

The country has seen the railroads legislated into white corpuscles. The average man looks on with equanimity, if not with I. W. W. glee, at every failure of the roads to secure equitable rates; and yet every proper advance in rates is a commentary on the prosperity of the people. Uniform prosperity is national prosperity. On the other hand, bankruptcy in any arm of fundamental industry affects unfavorably every other arm, and always points to general insolvency. Federal control, public ownership and other socialistic nostrums are the capital of merely cheap professors and self-seeking bureaucrats.

What has happened to one may happen to another. The experience of the railroads points a moral and adorns a tragic tale. It is a threat in the cumulus clouds of the western sky. It bodes an evil hour for you and yours. Mobilize, then, your varied and commanding talent, your splendid and brilliant genius, which serves in all your ranks, and, shoulder to shoulder, with characteristic determination, destroy the pernicious spirit of political witchcraft.

HIGH LIGHTS IN CENTRAL STATION SALESMANSHIP

BY L. A. McARTHUR

(Successful selling of electrical devices is a subject of permanent interest to Pacific Coast power companies. The same general principles apply whether the rate is made by the central station or by the dealer. A paper on "Practical Central Station Salesmanship," too long to be printed in full in these columns, is herewith summarized as to its salient features. Though confined to the sale of appliances by central stations it is filled with helpful hints for the dealer. The author is general manager of the Pacific Power and Light Company at Portland, the other members of his committee being George Bowen, S. A. Hoag, W. H. Lines, Lewis A. Lewis, and C. R. Young.—The Editor.)

Western central stations ought to sell at least $10 worth of electrical appliances to each consumer every year. Prices should not be cut. Profits should be at least 15 per cent. Installment sales should be encouraged.

Regular advertising should be carried in newspapers and favorable news items in every issue. Circular letters should be used only with carefully selected lists. Envelope stuffers in mailed monthly statements are effective. Demonstrations at fairs or clubs are good advertising but an expensive means of creating interest. Cooking schools are valuable means for selling ranges. House magazines and a company bulletin are effective means of stimulating merchandise sales. To benefit from field publicity "requires a man competent in passing on all forms of publicity and who, without being tied down will not deviate from the central station policy."

Greater effort should be put forth in exploiting the efficiency of electrical appliances in the home by the manufacturer. A $100 washing machine costs $17 a year to operate, including depreciation and current. The expense of a laundress for a family of four is $117 a year. This machine in its 12 years of life will pay for itself and return an actual saving of $100 per year. Capitalizing this saving, shows that the real value of a washing machine from the standpoint of comparative results is $1100, ten times its actual cost.

It pays a central station to merchandise lamps and motors. Bake ovens and electric water heaters should be sold at a profit.

Range sales are stimulated by a bonus plan. Salesmen should be specially trained. Liberal time payments are necessary. Every range sold should be closely followed by a home economist unless otherwise requesed. The first bills should be carefully analyzed before sent out. The straight house-to-house canvass is the most successful method of securing prospects.

The Electric Store

An electric store is a valuable auxiliary for increasing the load of existing consumers. They should be conducted under the policy of earnest and sincere co-operation with all the dealers, coupled with actual assistance along the lines of co-operative advertising and sales campaigns. "Take the dealer into your confidence, educate him along modern merchandising lines, and the time and effort thereby spent will repay you many, many fold. We sometimes note cases of central station merchandising going to extremes along these lines. For fear of incurring the displeasure of dealers, we even find stores established and conducted simply for display purposes and no actual sales made. We believe this plan to be wrong, both in theory and execution. No doubt the interest of the consumer is aroused, but what guarantee do they have of it being sustained. In other words, the time to turn a prospect into an actual sale is now, and if the opportunity is once passed up it may never occur again. As an answer to the argument in favor of these so-called display stores, we find in the larger cities where modern and aggressive electric stores are conducted by the central stations for the actual sale of appliances, that the large volume of business done by these stores actually stimulates sales on the part of the dealer, no doubt directly due to the far-reaching educational work conducted by the central station stores."

"In this so-called service branch we find our only excuse for departure from modern department store practice. In ordinary merchandising the sole source of revenue and profit is in the sale itself and the merchant confines his service effort oly along such lines as will induce the consumer to call on him again when in the market for additional commodities. In this respect our problem is radically different, and we can well afford to go to lengths in this work which it would be suicide for the ordinary merchant to attempt. The cost of this class of work is properly a charge against light and power earnings rather than against the operation of the store proper, and if the correct segregation of accounts is kept, no burden will be placed upon the store thereby. In fact, liberal service work is bound to stimulate further sales and thereby become a direct benefit to the store proper.

"The continual watchword in the conduct of the store should be 'maintain prices and merchandise for profit.' A survey was recently made in one of our larger Pacific Coast cities to determine how many dealers, electrical and otherwise, were selling appliances. The result of this survey was conclusive proof of the value of the policy maintained by this particular company. It was found that one hundred and one dealers were handling a complete or partial line of appliances and that these men considered this field a very valuable and lucrative one. It was further found that in two of the larger department stores the sale of appliances was on a greater scale than in the electric store itself. The reasons for this are not difficult to find. In the first place, these department stores were merchandising along somewhat better lines than the central station. Again the average housewife runs an active account in one or more of the larger department stores, and as a rule has occasion to visit them at more or less frequent intervals. What is more natural than her attention being attracted to a well displayed line of electric device, her interest aroused, that an order be entered to 'charge and send.' We have often assumed that an electric store if properly located, is one of the

best fields for the sale of appliances on account of the fact that our consumers make monthly trips into or past the store to pay their bills. There is no doubt that in this respect the electric store has some advantage, but it is in many cases given altogether too much prominence. There is a psychological question as to whether a consumer about to pay a bill, the size of which is many times questioned with or without due regard to conditions, is in a proper mental attitude to purchase a device to even further increase his bill.

"Any method which permits the advent of one hundred and one satisfied dealers into this appliance field is worthy of consideration and even duplication as it is a self-evident fact that ultimately more appliances will be sold in this manner than any one electric store could possibly hope to sell.

"The whole matter can be summed up by stating that the central station must merchandise along lines which will present conclusive proof that an actual profit can be and is made and further, the dealer must be convinced of this, his confidence and support secured and nothing undertaken on the part of the central station to destroy this confidence or weaken this support.

"The electric store if properly conducted along modern merchandising lines must and will show a profit on the actual goods handled. If the reverse is true, the trouble will be found in a neglect of one or more of the fundamentals which we have here attempted to outline in a brief and general way, and above all let us thoroughly grasp the evident truth that the electric store today is one of the most importan if not the most importan branch of our new business endeavor, and once this idea becomes firmly planted in our minds we will proceed in its operation with the same diligent efforts which have brought us success in other branches of our work."

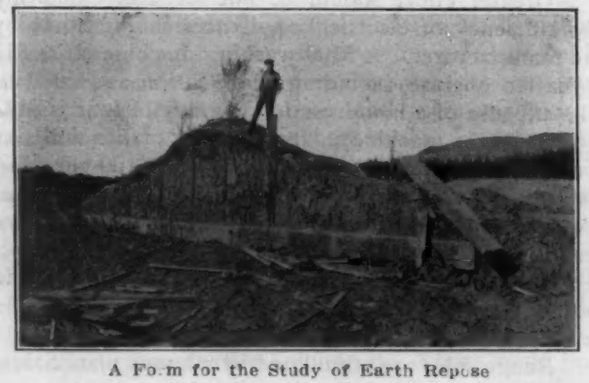
A store should be conducted strictly as a merchandising proposition. Methods and policies of large department stores should be studied and adopted. Selling campaigns of limited period and seasonable usefulness, good locations, fine appointments, forceful advertising and practical demonstrations are essential features. Store employes should be assembled in frequent meetings wherein they are taught the real value of the article for whose sale they are responsible. "A distinction should be sharply drawn between real value and mere selling price, and they should be thoroughly imbued with the idea of subordinating the element of selling price and substituting therefor the idea of real value, and to think and talk in terms of the latter. The measure of value of any such device depends on factors in no manner related to the actual cost of production, and sometimes widely separated from the selling price. Our economist friends tell us that such devices get their value from the standpoint of the result accomplished with a certain expenditure of energy as compared to an equal or better result which might be obtained with an equal or less expenditure by means of some similar device. Viewing our electrical appliances from this angle we are struck with the fact that their value in most cases greatly exceeds the selling price; that in their particular field of application no substitutes have as yet been found to accomplish equivalent results with anywhere near the same expenditure of energy. So let us put proper emphasis on this factor of value and demonstrate to our prospects the field of usefulness of these devices, the work they can accomplish, and let us subordinate the factor of price and raise that of performance."

"No electric store can possibly achieve a maximum of success unless every possible effort is bent toward keeping the appliances once sold in useful and workable condition, or if they become obsolete to replace them by new ones. Encourage all consumers to bring defective devices into your store for overhauling, irrespective of whether you made the original sale or not. This plan will greatly stimulate sales on the part of smaller dealers, who cannot afford to carry their service work to the extent you can and must."

PROGRESS ON THE SAN PABLO DAM

In the issue of the Journal of Electricity for March, 1, 1917, page 155, an account was given of the beginning of the new San Pablo Dam which is located in the San Pablo Valley about five miles north of Berkeley, and five miles east of the city of Richmond, in California.

Since that time work has progressed upon the project and its progress has been watched with unusual interest by engineers, in that its inception was fraught with a hard fought hearing before the California Railroad Commission and in the face of a constantly increasing rise in costs of material and labor.



A Form for the Study of Earth Repose

The month of September witnesses the temporary dam practically completed with a storage of water backing up in the channel of the creek for nearly a mile. The outlet tunnel has been driven, while the fifteen thousand foot tunnel that is to pass from a pond about a mile up from the dam, under Wildcat canyon, and out near the cemetery in North Berkeley, has been started.

The debris surrounding the former study in the character of earth at the damsite, a picture of one of the forms for which is shown herewith, has been removed and the effects of new construction work is visible on all sides.

The force of men working at the dam site has been greatly reduced. On the other hand progress on the long tunnel is very noticeable and this phase of the work is being pushed by the contractors with all reasonable speed.

THE ENGINEER AND THE COMMERCIAL DEPARTMENT

BY D. F. HENDERSON, L. T. MERWIN, J. L. DUFFY, J. C. HENKLE, A. S. HALL

(In the ideal situation, a single man trained along both commercial and engineering lines can handle to best advantage the building up of new business for a power company. Here is an excellent paper that will be of interest to all men of the industry throughout the West, in that pointers are given as to how the engineer may assist the commercial department in cases where the combination of commercial and engineering departments is beyond the capacity of a single man. The paper is to be read before the Spokane convention of the Northwest Electric Light and Power Association, September 12-15, 1917.—The Editor.)

The commercial man is often influenced by his desire to secure new business at a low cost, and he will overlook the fact that poorly built lines and equipment not properly installed will in all probability eat up all the profits of the business in maintenance and operating expense. On the other hand, the tendency of the engineer to install equipment and sightly work may lead him to refinements of construction not justified by the revenue secured from the business. There are many cases where the cheapest possible line to supply the immediate needs is the one to be built, but lines of that character form the smaller part of a central station's system, the majority of the business secured by such companies being of a rather permanent character and the ultimate economy of the equipment installed should be the governing factor. Operating features and reliability of service are important features and one must look into the future somewhat and imagine all sorts of happenings and try to determine what their effect would be in order to properly decide on the type of construction best suited to a particular case.

The primary object of the commercial man is to increase the business of the company and one of the principal ways of accomplishing this is to secure new customers who may or may not be located upon the company's lines. The commercial man finds through one or more of various channels that certain business may be secured and it is his duty to investigate and secure this business, if it is a desirable business for the company to have on its lines. In order that this business be served to the best advantage the various factors entering into such service must be carefully investigated and considered. Before approaching the customer the commercial man should know approximately whether or not it is within a reasonable cost to supply the service wanted. In the small ordinary business he can usually tell from a glance at the records in the engineer's office as to the probable cost of supplying the service and decide whether or not it will be profitable business. As our rates are now well standardized it is only necessary to estimate the amount and the time the customer will use his equipment to obtain the revenue and if this does not warrant the expense necessary to serve the business, the business should be rejected unless for reasons of policy it must be accepted or unless a portion of the cost is paid by the customer.

In cases where it is not at once apparent that the business can be secured and not apparent that the business once it is secured will be profitable, the commercial man should make a careful study of the situation as to the probable use of the power, estimated revenue, the permanency of the installation, time of day the load will be on, the importance of continuous service, etc. When this information, together with the location of the proposed service, is given to the engineer an estimate of cost and operating conditions can be made. If the business is of a permanent nature the construction work should be done in such a manner that it will still be serviceable after a long period of time. In ordinary practice all equipment should be of a character that would require small maintenance cost and provide safety to the public and to men working on the equipment. In cities and towns all work should be of the very best; wire sizes, capacity of transformers, etc., may be kept at a minimum, for increasing their sizes is not a serious matter except in the case of high voltage lines, where an interruption of service would be necessary to make the additions.

In building lines and supplying service to small communities a careful canvass of the prospective load is necessary. Comparisons with loads in other small communities are often of little value. An instance of this is shown by the experience of one northwest company in building into two small towns. The first town supplied was provided with a capacity of about 150 k.v.a. and the actual load was about 25 k.v.a. A similar town nearby was later supplied and the experience in the first town was used in determining the load to be expected. The new town proved to be a much better town and the load very quickly exceeded the 35 k.v.a. for which the line was built and business had to be refused, for the additional expense in rebuilding sixteen miles of 6600 volt line was more than the additional business was worth. Capacity sufficient to care for the increased load could have been supplied at the time the line was built for a very small increase in cost of line. This illustration simply shows that a careful study of all the conditions affecting a given proposition must be made. It is of doubtful economy to so cheapen the construction of a line to a new community that it will show a return on a certain definite known load in order to get authorization for the building of the line and then later to have to refuse business or rebuild the line. If the community to which the line runs does not show that any growth will take place, it is questionable whether or not the line should be built. On the other hand, construction not warranted by the business secured should not be put in. No doubt many lines have not been built, on account of the high cost, which could have been made into paying lines had better judgment been used in making the preliminary surveys, both commercial and engineering. It is necessary for the engineer and the commercial man to get together and work out the problem to decide on the relative importance of the various items entering into the business.

In city construction, excepting power loads, the growth of the service can be fairly well estimated by comparison with other parts of the city and with past loads. Such estimates are, of course, materially affected by the improvements in appliances anl lamps. The introduction of the tungsten lamp changed conditions in both residential and commercial districts to a great degree and the introduction of electric cooking devices promises to work as great if not greater change in central station policy.

There is probably no part of the central stations' activity where the commercial men and the engineering men need to be in closer touch with each other than in the pioneer work of introducing electric ranges and water heaters. The central station comes into more intimate contact with its customers in supplying this class of service than it does in any other. There is also a new element introduced, in that our dealings are with women to a much greater degree than in our other business. The electric range to a majority of our customers is a thing of the imagination and to successfully introduce it to them will require much work by the commercial men and also by the operating engineers. The operating engineers must see to it that the service supplied keeps the range sold after the commercial man has closed the actual sale. To begin with, a prospective customer under present conditions often takes a long time in deciding to have a range installed, but after having once decided is very anxious to have the service at the earliest possible moment, a natural desire, but one which may add materially to the central station's installation cost. Our present distribution systems are not designed and have not the capacity for a range of from five to ten kilowatt demand without reinforcing. When business is brisk the work of rebuilding the lines and installing the ranges can be materially lessened by the proper routing of the work. This may mean that some customers receive service more quickly than others and the commercial man in selling the range can assist the engineer by using good judgment in making promises of service. As one of the most serious handicaps to the range business is the cost of handling the service and installation of the range, anything that will tend to save money along this line should be given careful attention.

Now, as to the character of service required by electric cooking equipment, all are agreed that the service must be supplied from the regular 110-220 volt lighting mains, separate service for ranges being prohibitive in cost. In some cities the rates are such that separate meters are required, while in others all current is measured through one meter. Electric cooking appliances require good voltage and reliable service, so the best of construction should be installed. Poor service to a range customer not only means poor service to the one customer, but to his neighbors also. Fluctuations in voltage not only result in poor operation of the range, but of the lights, which is particularly disagreeable to the neighbor who does not have a range.

With the present prices of copper, in the majority of places it is cheaper to extend the primary feeders and install a transformer for range customers than to increase the size of secondary conductors. The experience of one northwest company along this line shows that the average cost of building the necessary line and running the service is about $100 per range customer where additional capacity in the line is required. This covers the cost of wire, transformer, poles, etc., and labor. Approximately 80 per cent of the ranges installed require additional line capacity, the other 20 per cent being located near a transformer or on a secondary main of large size. This percentage, where no construction is required, is gradually increasing as the number of ranges increases, for one range in a neighborhood often sells another one nearby.

Before we reach the point where a large percentage of our customers are using electric ranges, and we have from five to six ranges in every block, we must change our method of supplying service.

From data obtained by investigations of demand factors on several lighting feeders in Spokane it is estimated that we may obtain a demand factor of approximately four for groups of ranges on lighting mains. Using this value as a minimum (and we hope that the actual demand factor will in reality be greater than this) it will be necessary to provide secondary mains in each block to provide a load of 7½ k.v.a. in range load, assuming an average demand of 5 kw. per range. In addition to this a load of 15 kw. per block for lighting must be added, making a total load of 9 kw. per 1000 ft. of street. As a 30 k.v.a. transformer is a good standard size for use on overhead distribution lines, good practice would indicate that a 30 k.v.a. transformer be installed every thousand feet. To supply proper voltage to the service switch secondary mains of 1/0 copper would be required. The conductor cost per thousand feet of this size would be approximately $336 installed. (This is figured at 35 cents per pound in place; present indications are that copper will continue to be high in price for some time.) The transformer would cost approximately $200 installed, making a total of $556 for transformer and secondary mains. Transformer and secondary mains to supply the lighting load of this same territory would cost approximately $65 for the transformer of 5 k.v.a. capacity and $84 for a No. 6 secondary main, a total of $149 per thousand feet, extra guying due to heavier conductors would amount to about $20 per thousand feet. The additional cost of the larger service over a lighting service and the additional cost of a larger meter is about $8 or $134 per thousand feet. The total additional cost of supplying the thousand feet of combined range lighting load would then be $556 + $134 + $20 — $149 or $561 per thousand feet. As we have assumed an average of 16.7 ranges per thousand feet the additional cost to serve range consumers would be $561.00/16.7 = $33.30.

Primary feeders to supply these transformers must be provided. A 150 ampere regulator is a convenient size, and a 4000-volt four-wire feeder would care for approximately 900 k.v.a. load to a load center 1½ miles from the station, with a wire size 1/0 copper. From the load center the feeder would divide into three single-phase feeders and approximately 2½ miles of wire would be needed in the branch feeders. A feeder of this character would cost approximately

$8750, or $2920 each, exclusive of pole lines, considering the feeder as three-phase feeders. A primary feeder to supply the lighting load for this same territory would cost, with No. 6 copper, approximately $1200, the cost of lighting feeders being much more per kw. of capacity than the heavier feeder because the load is scattered over such a large territory and operating conditions would require that the feeders be confined within a reasonable territory. Deducting this from the cost of the heavier feeders gives an added cost of $1,720 for the range load.

The demand factor of the ranges supplied by this larger feeder would be about 5. Reducing this to the basis of one block we would have a demand of 6 kw. instead of the 7½ kw. as in the case of the secondary mains. Adding to this the 1.5 kw. lighting load gives us a total load of7½ kw. per block or 20.8 kw. per 1000 ft. Each single phase feeder is sufficient to carry a 300 kw. load and would serve a territory having (300/20.8) 14,400 ft. of secondary main. As we have assumed a supply 14400 × 16.7 or 235 ranges. This gives us a cost per range 1710/235, or $7.30 additional to the cost of lighting service. This makes a total conductor expense additional to lighting service of $33.30 + $7.30 or $40.60 per range.

The above figures cover the necessary feeders, transformers, secondaries, meters, etc., to supply a mixed lighting and range load at the time the range has reached a density of six 5 kw. ranges per city block. The time that will elapse before this density will be secured has a great bearing upon the determination of the type of construction that should be installed at the present time. This load is being built up gradually, a range here and a range there, and our problem is to decide on the best course to follow. As explained earlier in the paper, present practice of most companies is to run small primary wires and install small transformers at or near the point where the range service leaves the secondary mains, at a cost of about $80 per range on the lines. The difference in cost between the two methods does not necessarily mean that it will cost that much additional per range when the total number has been installed, for as the territory becomes saturated a large number of these transformers will be removed and a part of the copper replaced and considerable salvage will be secured, but there is no doubt that the present method is the more expensive one and the difference is great enough to warrant the various companies in making a very exhaustive survey of their system and determine the procedure to be followed. To make an estimate of the growth of the range business will require that the commercial men and the engineers work together on the problem and give their best thought as to the time and place where range load may be expected.

As has been pointed out after the range has been installed it is the duty of the central station to see that it gives satisfaction and salesmen and demonstrators can materially increase the service a range gives by fully explaining the various features of the range and its operation. Experience has shown that this has been done to a great extent, for comparatively few of our complaints are traceable to misuse by the customer. 'Tis true we run down cases of trouble and find them to be due simply to the turning of the wrong switch, not closing the circuit breaker, cleaning open coil elements while current is on, etc., but the most of our expenses in maintaining ranges is due to burned out coils, breaking down of switches, etc. One company has found that over a six months' period with an average of 374 ranges in service the maintenance and operating costs amounted to 88 cents per range per month, and was divided as follows: Labor, 38 cents; transportation of men and materials, 6 cents; material (new elements, switches, etc.), 44 cents. It is to be hoped that this cost may be reduced, guarantees on range parts are becoming more standardized and the tendency is for central station to charge the customer for these repairs after the guarantees have expired.

Water heating in connection with range installation presents a somewhat different problem, as the water must be conserved more than when heated from a furnace or a coal range, and salesmen, demonstrators and trouble men can all "do their bit" toward bettering conditions. Few customers pay any attention to the quantity of water used or wasted. Dripping faucets and poorly arranged plumbing are points that cause poor service from a water heater, and imagination has much to do with the attitude of the customer. This is illustrated by the experience of one man who thought he had a two kilowatt heater and who had plenty and to spare of hot water. One day there was trouble on the circuit and he discovered that the heater was really only a one kilowatt heater and since that time he has been complaining that he does not get sufficient hot water.

The above illustration simply serves to point out that the commercial men and the engineers of a central station have largely the same problems and that it is extremely necessary that they work together and not get "wires crossed," and each company must fit its organization to meet its own problems and the individual characters of its men.

CENTRAL STATION ENLISTS HOUSEWIVES IN FOOD PREVENTION

Considerable interest is being aroused by a window display of the Glenwood Light & Water Power Company of Glenwood Springs, Colorado, in which fruit and vegetables are dried by an electric fan. Four racks made of light wood with wire mesh bottoms are set up in front of a 10 in. Westinghouse fan. Each rack is large enough for six quarts of material. A watthour meter indicates the exact cost for each run. In an advertisement in the local paper the company asks housewives to bring their fruits and vegetables and have them dried free of charge. Reference is made to Farmer's Bulletin No. 841, which describes the process.

The efficiency of a pump means the total work performed as compared to the power required. The weight of water pumped per minute times the total head in feet will give foot pounds; this divided by 33,000 gives the theoretical horsepower or the work performed by the pump. The power delivered to the motor, measured by checking the meter with a stopwatch, shows the electrical input figured in horsepower.

CO-OPERATION WITH ARCHITECT AND CONTRACTOR

BY A. C. McMICKEN

(These pertinent suggestions as to bringing about a more complete wiring of homes and apartment houses place the initiative and responsibility on the central station. They constitute the gist of a valuable paper on "Co-operation in Modern Home and Apartment House Wiring Practice" to be presented before the Northwest Electric Light and Power Association convention at Spokane this month. The author is sales manager for the Portland Railway, Light and Power Company, and was assisted in the preparation of this paper by H. H. Schoolfield, F. H. Murphy, Foster Russell and L. R. Grant.—The Editor.)

The steady increase in the efficiency of incandescent lamps and the constant revision downward of lighting rates is seriously affecting residence earnings and the problem of keeping these earnings up is not solely one of selling current-consuming devices, but includes providing facilities for using them conveniently and safely.

We should be looking ahead, not one year or two years, but ten years, and endeavor to picture conditions in the future. Begin now to prepare for changes which are bound to come at least insofar as they will affect the use of electricity in the home.

During the past ten years the more common lamp socket devices have sprung into being and have become well established, and now the vacuum cleaner, washing machine and electric range and water heater are becoming recognized as practical household necessities. The electric range is not yet universally established and accepted—not because it is not a splendid cooking medium, but because we have not all gotten behind it, and because we have not yet had time to educate our consumers to its many advantages.

The day of the electric range is fast approaching, as also is the day of every other electric household labor saving device. Fuel, whether it be oil, coal, wood or gas may be expected to increase in price as time goes by. This is our opportunity. Are we preparing for it?

In order to arrive at some definite idea for co-operation sets of questions were sent to architects, building contractors, wiring contractors and central stations. From the answers to these questions it is apparent that the architects consider that they are specifying ample circuits for lamp socket devices and the like, but are not yet convinced that circuits for ranges and water heaters are necessary; and it is further apparent that but a small percentage of homes are built under the architect's supervision.

Someone has said, "You can't tell an architect anything." Have you a wide acquaintance among the architects in your territory? Do you know a class of men any quicker to adopt improved methods and practices? Perhaps the reason you do not get full co-operation from architects is due to your method of approach.

Building contractors and home building companies and associations who build homes for sale costing from $4000 up provide a fair amount of convenience circuits and outlets, but need to be educated to greater effort. The vast majority of houses built without architects' supervision, whether for sale or for the owner, do not have sufficient convenience circuits and outlets and in many instances do not have ample lighting circuits and switch control. This is largely due to houses being built for a lump sum, the wiring, as well as other items, is cut down.

Both building and wiring contractors report that they have difficulty in convincing the owner of the desirability of convenience circuits and outlets except for certain appliances such as an iron outlet in the kitchen. In most instances the matter is given little consideration by either the building contractor or the owner.

The contractors suggest that suitable literature setting forth the desirability, convenience and utility of convenience circuits and outlets sent the owner or prospective home builder when plans are being made or at the time building permits are taken out would greatly assist them in having such circuits installed. They suggest that this should be the function of the central station.

It is well to state here that we cannot expect to have the co-operation of the wiring contractors if we are to compete with them in their field. Electrical contracting is a legitimate and specialized business, and one in which the central stations should not engage unless the community served is too small to support a local wiring contractor. Some central station managers still consider the contractors fair-weather friends, and make no effort to really get acquainted and find out that the average contractor is a regular fellow after all.

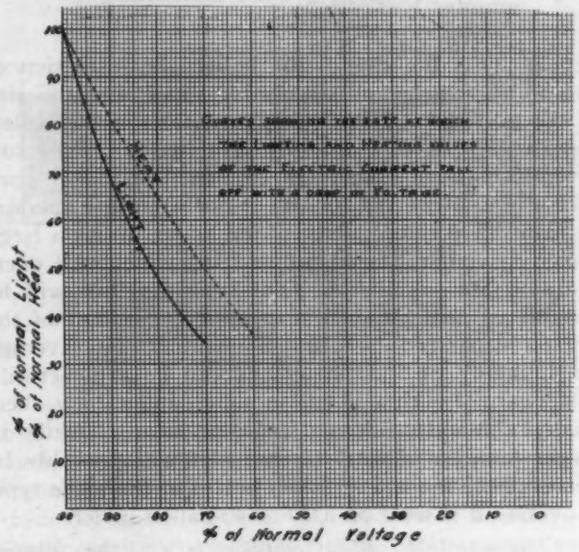
It has been proven that the wiring contractor can be of great assistance in inducing the owner, architect and building contractor to make provision for range and appliance circuits and outlets. In many instances the contractor also sells appliances and is therefore doubly interested in seeing ample convenience circuits and outlets installed.

Houses and apartment houses built for sale or rent will not do, either, unless wired for electricity and the demand for convenience circuits and outlets is increasing. A woman used to electric light and appliances, when house hunting invariably notices whether the switches are conveniently located and whether convenience receptacles are provided. Many already built houses have been wired solely because the occupant wanted to use an iron or other device.

Salesmen for one of the large home building concerns carefully call the attention of prospective buyers to the ample and conveniently located switches provided and also to the baseboard, wall or floor receptacles in every room for the vacuum cleaner, piano lamp, etc. They know it helps to sell the property.

The fact that practically every house and apartment building erected in the last four or five years in the Pacific Northwest was wired at the time for electric light does not mean we need not bring to the attention of the builder and owner the desirability for a better standard of wiring and illumination.

A home or an apartment house is not built to last a year or so, but to last a lifetime. Why not wire it now so that electricity may be conveniently and safely used to operate anything from an iron to an electric range? The owner may not contemplate installing an electric dishwashing machine in the kitchen at present, or a washing machine in the laundry, but he will have both some day and the outlets should be provided while the house is still on paper and the outlets can be added with the least additional expense.



Relationship of Lighting and Heating Values with Drop in Voltage

The following suggestions are therefore made to member companies:

Get acquainted with and seek the co-operation of the electrical contractors in your city or town. Go out of your way to help them and they will be more than glad to reciprocate. If the electrical contractors have a live association your problem is greatly simplified, and their assistance backed by their association can be secured and will be of great value. If the electrical contractors in your town do not have an association or do not belong to the state association, urge the latter to get them in. If this cannot be done, you can at least get them together and work out a mutual co-operative plan in your city or town.

Have your salesmen keep in touch with the wiring contractor. Many times after the wiring contract is let, co-operation of the contractor with a central station salesman has resulted in additional wiring. The electrical contractor and the central station salesman by good team work can influence the owner, building contractor and architect.

Every central station salesman should know more than the rudiments of illuminating engineering and good wiring practice and should be able at all times to make pertinent suggestions to the contractor and the home builder, which, if adopted, will provide good illumination and for the convenient use of current consuming devices.

Most important of all, you should endeavor to see every home owner as soon as you have information that he is about to build. Every man and woman building a home wants to include in it every convenience and comfort that their means will permit. Much time and consideration are given to planning the new home, but in the majority of cases the matter of electrical wiring is not understood or is not given the consideration it warrants, and when the home is completed regret is often expressed because convenience outlets were not installed for the vacuum cleaner, percolator and other devices, and the home builder cannot understand why the fixtures and glassware which looked so well when purchased proved so disappointing when installed. The interiors of many otherwise beautiful homes are marred by fixtures improperly located, inharmonious in appearance and improperly equipped with glassware.

We believe that suggestions for convenience circuits and outlets properly made to the home builder will be gratefully received, and that this should be as much the duty of every salesman as to secure the lighting contract. If you cannot have a competent salesman call and present arguments for better lighting and convenience outlets, send suitable literature, or, better still, send the literature and follow it up by a call from the salesman.

The N. E. L. A. Publication Committee has recently issued a handsome illustrated booklet with this purpose in mind and they can be purchased in any quantity for distribution in your territory. Architects, contractors and builders can use advantageously, and the central station can mail them to the owner with a suitably worded letter offering the services of the illuminating engineer or the man in the organization capable of doing this work.

If you feel that the expense of purchasing or having printed suitable literature of this character is too great, it is at least possible for every central station to prepare a letter setting forth concrete reasons for convenience circuits in the home and designed to create a desire for electric labor saving devices, which can be mailed at small expense.

We believe that the larger central stations can well afford to employ an illuminating engineer, who can make himself invaluable to the architect, contractor and owner by preparing wiring plans and specifications and making suggestions as to the color of walls, ceilings and draperies best adapted to the lighting effects desired, with due consideration for the type and class of fixtures and glassware to be used.

The illuminating engineer will also instruct and assist the salesman along illuminating engineering lines, which, by the way, is not confined to the proper design and location of lighting installations only, but applies equally as well to making provisions for current consuming devices and motor loads.

After all is said, the man who pays the bills is the man who must be convinced. Co-operate with the architects, the building and wiring contractors, but above all bring your heavy artillery to bear on the home builder and owner. He will spend the money for comforts and conveniences for his loved ones if you can convince him that electricity will lighten their household tasks and make life more enjoyable.

RECENT PROGRESS IN ELECTRIC WATER HEATING

BY A. STRAUCH, L. R. GRAND AND R. A. WILLSON

(Herein are briefly summarized the important features in a paper to be presented at the N. W. Electric Light and Power Association Convention. Full details are given regarding proper rates, the selection of the heater, the manner of installing and the thorough insulation of the boiler.—The Editor.)

Electric water heating is the necessary complement to successful electric cooking. Without it the consumer derives only half the anticipated convenience, comfort and cleanliness of the electric way and the central station only half the revenue.

Contrary to the general practice in the Northwest of making a certain meter rate for cooking and a flat rate for water heating the committee recommends a sliding scale block rate designed so that the

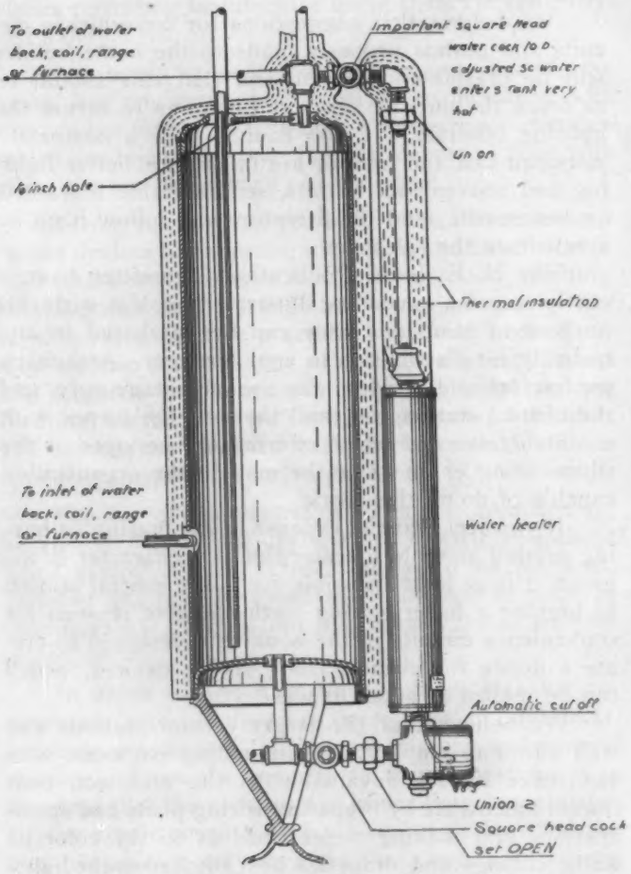

To outlet of water back, coil, range or furnace
Important square head water cock to be adjusted so water enters tank very hot
Union
¼ inch hole
Thermal insulation
To inlet of water back, coil, range or furnace
Water heater
Automatic cut off
Union 2
Square head cock set OPEN

Fig. 1. Method of Installing Electric Heater

average lighting can be covered by the first step, the cooking by the second step and the water and air heating by the third step. A yearly minimum is preferable to a monthly minimum.

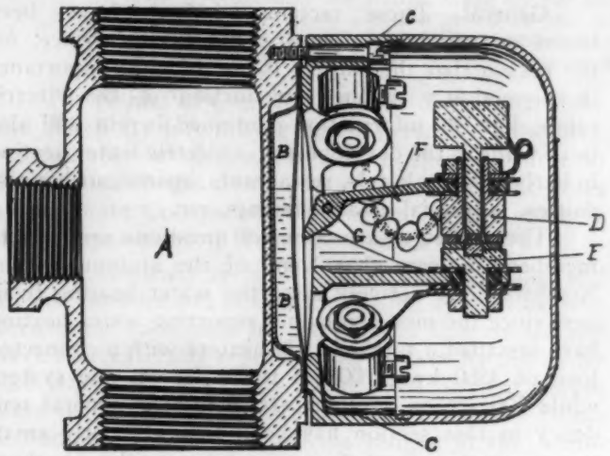
By using a large capacity heater installed with a double throw switch between it and the range the maximum demand is reduced and the load factor improved while the service is in no way impaired. An automatic circulating type of heater gives the best service.

The consumption of such a heater averages 3 to 4 kw.-hr. per day per person and in general a rate of 1c per kw.-hr. will make the cost of operation satisfactory to the average consumer.

Size of Heater.—If the maximum demand in gallons of hot water per 24 hours is known the size of the heater required can be obtained from the formula watts $= \frac{146 \times \text{gallons} \times \text{deg. F. rise}}{\text{minutes} \times \text{efficiency}}$. The efficiency will depend upon the size of the boiler, the insulation of the boiler, heater and circulating pipes, and the size of the heater, but for average conditions if the boiler, pipes and heater are properly insulated it will be sufficiently close to assume an efficiency of 85 per cent. The size of heater and hours of operation are also dependent upon the capacity of the boiler. With a large boiler a smaller heater can be used which will operate a greater number of hours per day, but will be capable of caring for the demands on account of the greater capacity on storing hot water. The average small family of 3 or 4 persons can be satisfactorily taken care of with a 30 gallon boiler, and a 2 kw. thermally controlled circulation type heater, while in larger families of 6 to 8 persons it will probably be necessary to use a 3 or 4 kw. heater of the same type, providing it is used on a 30 or 40-gallon boiler.

The method of installation is of the utmost importance and means the success or failure of the whole service. The heater should be attached to the boiler as shown in Fig 1. The bottom of the heater must be as low or lower than the bottom of the boiler, otherwise the water will not continue to circulate after it has been heated down to a level with the bottom of the heater, but steam will be produced (the thermal switch not operating if installed at the bottom of the heater until hot water begins to feed ino it) thus reducing the storage capacity of the boiler. The heater should be so connected as to take cold water from the bottom of the boiler and deliver hot water at the top; it should never be tapped into the side as is the usual practice for connecting the water back of a stove. This for the reason that should all the hot water be drawn off, in a few minutes there would again be a small supply at the top of the boiler with which to meet further demands. There should be inserted above and below the heater square head service cocks, and between the heater and the cocks, unions, one on either side of the heater, then in case of trouble the two cocks may be closed and the heater easily removed without drawing off the water. Further, the most important function of one of these cocks is to restrict the circulation of the water, so as to cause it to heat to a high temperature before passing out of the heater. There are three makes of heaters fitted with restricted openings for this purpose, but so far as this Committee knows they are the only ones so arranged, and even though the heater may be so fitted, it is desirable to use the cocks if for no other reason than the added convenience in case of trouble. In setting the cocks it is desirable to close them to a point where the water when it passes out of the top of the heater

is at a temperature of 160 degrees to 175 degrees F. Another function of the cocks is to retard the by-passing of cold water through the heater when hot water is being drawn from the top of the boiler. Without the cocks there is a marked tendency for cold water to pass from the bottom of the boiler through the heater and mix with the hot water being drawn from



The Thermal Switch for Electric Water Heating

the top, thus reducing the temperature of the water before it reaches the faucet. The cocks when properly set offer sufficient resistance to reduce the by-passing to a negligible amount. It is desirable to use square head service cocks rather than Globe valves as the cocks are set with a wrench and tightened up where they usually remain. While in the case of the hand operated valves, there is too much temptation on the part of the consumer to turn them and thus change the adjustment.

Boiler Insulating.—After the heater has been connected to the boiler, and the cocks properly adjusted, the boiler should be thoroughly insulated from bottom to top including the heater and circulation pipes as well as the hot and cold water pipes leading from the top of the boiler to the point where they enter the wall.

If such a cover as the J-M "Economy" Felt Jacket is used, it should be well sewed up and a bottom section used to entirely cover the boiler. The heater and pipes should be well insulated with magnesia or a similar pipe covering about 1 in. thick. If Sil-O-cel is used, a box should be constructed about the boiler allowing approximately three inches of space between the sides of the boiler and the box, which should extend well above the top of the boiler so as to allow of a good deep covering of the insulating material over the top including the pipes as mentioned. It is usually possible in such cases to run the circulation pipe inside of the box from the top of the heater up. In such cases the heater and exposed portions of pipe can be insulated with magnesia covering, or another box may be constructed enclosing the heater and these pipes. In case the circulation pipe can not be enclosed in the box with the boiler it must be covered.

Automatic Thermal Switch.—There is now on the market a simple and reliable thermal switch which can be easily installed in the pipe below any of the standard circulation type heaters, thus making them automatic, so that non-automatic installations can be readily converted to automatic at slight expense as the switch is sold for $7.00 or $8.00.

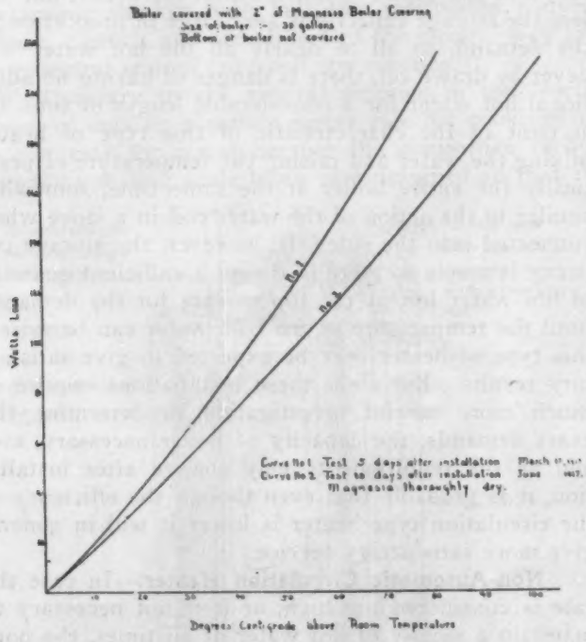
Automatic Immersion Heater.—The thermally controlled immersion type of heater can also be used in place of the circulation heater described, in which case the radiation losses will be somewhat reduced, due to the absence of the circulation pipes, and the fact that the heater is itself within the boiler, but unless the storage capacity is very large in proportion to the demand, so all or nearly all the hot water will never be drawn off, there is danger of having no additional hot water for a considerable length of time, on account of the characteristic of this type of heater mixing the water and raising the temperature of practically the entire boiler at the same time, somewhat similar to the action of the water coil in a stove when connected into the side. If, however, the storage capacity is ample so there is always a sufficient quantity of hot water left at the top to care for the demands until the temperature of the cold water can be raised, this type of heater may be expected to give satisfactory results. But since these installations require so much more careful investigation to determine the exact demands, the capacity of boiler necessary, etc., and as the requirements may change after installation, it is probable that even though the efficiency of the circulation type heater is lower it will in general give more satisfactory service.

Non-Automatic Circulation Heater.—In case the rate is considered too high, or it is not necessary to maintain a supply of hot water at all times, the non-automatic circulation type of heater of rather large capacity installed as described for the automatic heater on a double throw switch with the range will give very good service but in case such installations are made it will be desirable to use heaters of a 4 to 5 kw. capacity in order to quickly produce a supply of hot water. With this arrangement it is possible to

Typical Details for Electric Water Heating Devices

get through with a much lower consumption of energy, for the reason that the radiation losses are reduced and if hot water is not always instantly available at the faucet, cold water will be used for many purposes where otherwise hot water would be drawn thus reducing the demand. This arrangement would equal the service of the ordinary circulation type gas heater and it is possible to furnish a limited supply of hot water at rates of 2c to 3c per kw.-hr.

Non-Automatic Immersion Heater.—A considerable number of non-automatic immersion heaters of small capacity have been installed in the Northwest, but as previously stated, heaters of this design cannot be expected to produce the results of the larger thermally controlled circulation type, due to the mixing characteristics and the impossibility of keeping up the supply under all demands. But of course they,


Boiler covered with 2" of Magnesia Boiler Covering
Size of boiler :- 30 gallons
Bottom of boiler not covered
Watts Loss
Curve No 1. Test 5 days after installation March 1st.
Curve No 2. Test 10 days after installation June 1st.
Magnesia thoroughly dry.
Degrees Centigrade above Room Temperature

A Test on Magnesia Boiler Covering

like the automatic immersion heaters, have a field and under certain conditions will produce satisfactory results.

Radiant Plaster Type Heater.—There is in use on the circuits of one station a heater of small capacity consisting of a number of radiant coils attached to an insulating block which is clamped to the side of the boiler, the advantage claimed for this heater is that it can be easily and cheaply installed, and that no trouble will occur due to a collection of deposit from lime in the water. But to offset these advantages it has the disadvantage of slowness, and the mixing of the water like the immersion heater, while it does not operate at the high efficiency of the latter type.

Instantaneous Type Heater.—If the rate is high and water is required at only one or two faucets the most efficient and inexpensive heater is the instantaneous type without coils or switch, and having the current limiting feature.

There is now available such a heater in which the heating element consists of two electrodes, one a tube and the other cylinder, the water being heated by the current passing through it from one electrode to the other, it acting as a simple water rheostat. By merely turning the valve water is slowly admitted from the bottom and gradually rises filling the space between the electrodes, and in so doing the current is correspondingly increased from nothing to maximum; when the valve is closed the water is drained from the bottom with the result that the load is gradually reduced to zero. Therefore this heater, unlike other designs of instantaneous heaters, does not produce the detrimental effect on the regulation of the circuit. Heaters of this type of approximately 5 kw. capacity can be installed on double throw switches with ranges, and will produce water at any desired temperature up to the boiling point in limited quantities at a very low cost.

General.—These recommendations have been based on supplying domestic hot water service, for the reason that the subject is one of vital importance in connection with the introduction of the electric range, but the information contained herein will also be of value in the development of electric water heating in barber shops, hotels, restaurants, apartment houses; dairies, industrial establishments, etc.

The replies to a number of questions sent out to members indicate that some of the stations of the Northwest are actively after the water heating business since the nine companies reporting water heating have installed a total of 1930 heaters with a connected load of 3560 kw.; 1000 of these are on one system while 500 are on another. It seems the general tendency in this section has been to use mostly small non-automatic circulation type heaters, though there are also a considerable number of small capacity non-automatic immersion type, though every one admits they have some trouble in meeting maximum demands and the heaters are slow.

Practically all of the business is handled on flat rates, which doubtless accounts for the low capacity of the heaters and the small number of thermally controlled (or automatic type) heaters in use. This again brings to attention, the wastefulness and other short comings of the flat rate practice. While most of the companies appear to be insulating the boilers, it is rather surprising to note that the station with the largest number of heaters in use is not insulating many of the boilers. Since this is a matter of such vital importance on account of the extremely high radiation losses it is a matter that requires careful attention, and should never be neglected. Those who are not insulating the boiler are simply throwing away energy. For the benefit of those who are having trouble with scale forming in the heaters, the committee would suggest that they can easily clean it out by removing the heater and filling it with a 36 per cent solution of Hydrochloric acid, which will dissolve it almost instantly without damage to the heater. Where the water is bad they should be inspected and cleaned regularly. Practically all seem to be agreed that water heating will assist in the introduction of electric cooking.

All workmen's check clocks are controlled electrically in England by their Pulsynetic electric transmitter, thus insuring correct and uniform time throughout the establishment. The system is so elastic that any number of check clocks or time dials may be added to the circuit as the occasion demands, and alarm bells or sirens can be operated automatically to any given programme or programmes. In many instances these programmes vary with the day of the week, and also with the department.

COOKING TESTS BY FUEL AND ELECTRICITY

BY B. L. STEELE

(Electricity in cooking is each month coming to the front in ever expanding uses. Comparative tests of coal, kerosene and electricity for cooking have long been lacking throughout the West, where wide applications of the electric range are but waiting the proper scientific exploitation of the power salesman. Here is an excellent article on this subject compiled by the author, who is professor of Physics at the State College of Washington. The paper has been prepared for the convention of the Northwest Electric Light & Power Association at Spokane, Sept. 12-15, 1917.—The Editor.)

The results of comparative tests of coal, kerosene and electricity for cooking herein presented have been accumulated in connection with a special course in Physics which the writer has given for several years at the State College of Washington for the students in the department of Home Economics.

The efficiency tests of gas, kerosene, gasoline and alcohol burners and of electric heating appliances have been made each year by the girls in this course and have been carefully repeated and checked by the writer and laboratory assistants. The tests on coal ranges were made on the two Monarch ranges in the Home Economics department, on the ranges in the homes of students living in Pullman, and at sorority houses.

The Jensen Apartments, Great Falls, Montana, Equipped with Electric Ranges

The cooking cost data were obtained at the Home Economics Practice Cottage.

Table 1 gives the value in calories, or the heat equivalent, of 5c worth of each of the various "fuels" at the prices prevailing in Pullman, Washington, in December, 1916:

Table No. 1

Fuel	Calories
Coal (Rock Springs) at $10.00 per ton	32,250,000
Kerosene at 20c per gallon	8,550,000
Gasoline at 25c per gallon	6,130,000
Alcohol at 75c per gallon	1,340,000
Electricity at 3.85c per kw.-hr.	1,116,000

Table No. 2 gives the average efficiencies of the various kinds of cooking equipments. In determining the maximum efficiency of the coal range the entire top was covered with large vessels of water—e.g., wash boilers or five gallon gasoline cans, the oven being similarly used. The fire was not lighted until the initial water temperature had been taken and usually two pounds of kindling and ten pounds of coal were completely burned before the record of the final maximum temperature was made. It was estimated that, as the coal range is used for cooking in the average home, not more than one-fourth of the available space is utilized at any one time, and that the cooking operations are being carried on less than one-half of the time during which the coal is burning. If this estimate is correct, the average "cooking" efficiency of the coal range does not exceed two per cent.

Table No. 2

Kind of Cooking Equipment	Efficiency
Coal range (entire space utilized)	18%
Coal range estimated home cooking (about)	2%
Flame contact burners (kerosene, etc.)	28%
Electric heaters, surface	45 to 65%
Electric heater, enclosed	70%
Electric heaters, immersion	90%

The efficiencies of the flame contact appliances, which include standard kerosene and gasoline blue flame burners, alcohol lamp for chafing dishes, and gas burners, varied from approximately 20 per cent to 35 per cent. The caloric value of the various fuels were obtained either from dealers or standard handbooks, or were determined in the laboratory.

Nearly every kind of electric heating appliance was used and under widely varying conditions. Room temperatures, existence of air currents from open windows, material and condition of surface of utensil used, wattage of heater, relative size of heater and utensil, and quantity of water heated, were all found to affect the efficiencies very considerably, particularly those of the surface and immersion types. In these experiments the thermometers, standard ammeters and voltmeters and the balances used were such and the care exercised was such, that a variation in efficiency greater than 1 per cent was not to be attributed to accidental error.

Table No. 3 gives the data and results of several efficiency tests of electric heaters.

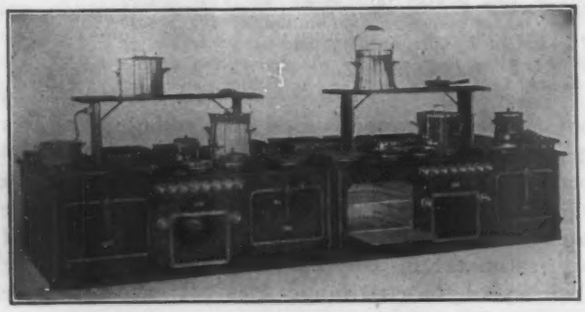
Table No. 3

Items	Surface Heaters A	Surface Heaters B	Enclosed Heater	Immersion Heater
Mass of water heated (grams)	4.536	4.536	2.268	1.360
Room temperature (Cent.)	21°C.	22°C.	21°C.	22°C.
Initial water temperature	18.2°C.	22.6°C.	16.4°C.	19.5°C.
Final water temperature	93.2°C.	96.5°C.	65.0°C.	92.0°C.
Temperature increase	75.0°C.	73.9°C.	48.6°C.	72.5°C.
Heat absorbed (calories)	340,200	335,200	110,225	98,600
Heater turned on	3:00	12:13	7:37	9:30
Heater turned off	3:32	12:58:30	8:33	9:46:49
Time in use (seconds)	1,920	2,730	3,360	1,009
Current (amperes)	10.32	8.69	1.63	4.00
Potential difference (volts)	115.0	115.0	110.0	110.0
Electric energy expended in heater (Joules)	2,278,656	2,730,000	602,448	443,960
*Heat equivalent of electric energy calories	544,221	652,000	143,880	106,033
Efficiency	62.5%	51.4%	76.6%	93.0%

*4187 Joules are equivalent to 1 calorie.

The average working efficiency of the electric range, as used in the home depends on so many factors that to make an accurate estimate is rather difficult. It is believed, however, that in the hands of those who have had a bit of experience in making the proper combinations of surface, enclosed and immersion heaters, the efficiency should be above 60 per cent.

Table No. 4 gives the heat available for cooking in 5c worth of each of the "fuels," proper allowance having been made for the working efficiencies of the various cooking appliances.



Electric Ranges Installed at the Montana State Hospital, Billings

Table No. 4

"Fuel"	Calories
Coal (range at 2% efficiency)	623,000
Kerosene (range at 28% efficiency)	2,400,000
Gasoline (range at 28% efficiency)	1,716,000
Electricity (range at 60% efficiency)	669,600
Alcohol at 28% efficiency	375,200

For the purpose of affording laboratory work in the course in Household Administration, the Department of Home Economics at the State College at Washington maintains a Practice Cottage. The seniors each year are divided into groups of four students each and each group, together with a chaperon, spends four weeks in the cottage. This arrangement permits each student to have the management of the cottage for one week. Before entering upon the month's work at the practice cottage, each of the four girls has made out a week's menus and has determined the necessary quantity of each article of food entering into each menu, according to the needs of the members of the group. The girls are "weighed in" at the beginning and "weighed out" at the end of the month and in most cases are found to have fared better than on their regular boarding house or home cooking.

During this year, through the generosity of the Washington Water Power Company, the practice cottage has been equipped with a Westinghouse electric range in addition to the coal range. This arrangement has made it possible to obtain data on the cost of cooking with coal and electricity for a family of five. During the winter when the furnace was in use, the water front of the coal range was disconnected, the hot water for domestic use being furnished entirely by the coil in the furnace. During the late spring the water front was connected up and all hot water needed was heated by the range in connection with the cooking.

In considering the results which follow, the fact that the work was carried on by students who were busy with other regular college work must not be lost sight of, and it should be mentioned also that each of the 19 girls who lived in the cottage had had considerable experience cooking on the coal range and that none of them had had experience with the electric range. To help us out of this difficulty the Washington Water Power Company very generously offered the services of their expert, Miss Addison, who gave demonstrations to the groups on several occasions. Each student, whether cooking on the coal range with or without the water front or on the electric range, was instructed to practice economy as much as possible.

Table No. 5 gives the cost by meals of one week's cooking on the electric range and Table No. 6 gives the week's menus. Two meters were provided, one for the oven and boiler, and one for the plate. The meters were read before and after each meal and in every case tenths of kilowatt-hours were carefully estimated.

During the month of December, 1916, the average value of a kilowatt-hour in Pullman was 3.85 cents. This value was used in calculating all the electric cooking costs.

Table No. 5—Electric Range

Kilowatt Hours

	Breakfast		Lunch		Dinner	
Day	Oven	Plate	Oven	Plate	Oven	Plate
Monday	.5	.1	.7	.2	1.0	0.0
Tuesday	.7	.5	.5	0.0	.6	.4
Wednesday	.5	.1	.5	0.0	2.4	.7
Thursday	.6	0.0	1.0	0.0	1.4	0.0
Friday	.6	.2	.6	0.0	.3	.8
Saturday	0.0	1.0	.5	.2	2.0	.6
Sunday	0.0	.3	1.1	.4	0 0	0.0
Total kw.-hrs.	5.1		5.7		10.2	
Total cost (cents)	19.6		21.9		39.3	
Cost per meal	2.8		3.13		5.65	

Total cost for week ..... 80.8 cents

Average cost per meal ..... 3.85 cents

Table No. 6

Week's Menus—Electric Range

Day	Breakfast	Lunch	Dinner
Monday	Cream of Wheat Corn Muffins Syrup. Coffee	Creamed Potato Bread and Butter Apple Sauce	Roast Pork, Potatoes Tomatoe. Apple Sauce Bread and Butter
Tuesday	Baked Apples Muffins. Coffee	Rice and Cream Bread and Butter Salad	Spaghetti and Cheese Fried Potato Buttered Carrots Cottage Pudding Bread and Butter
Wednesday	Graham Mush Rolls Coffee	Cheese Sandwich Apple Sauce Cake. Chocolate	Veal Loaf Baked Potato Creamed Onions Gravy Rolls. Jelly Cake Coffee
Thursday	Marmalade Rolls Coffee	Escalloped Potato Tea. Baked Apple Bread and Butter	Creamed Salmon on Toast Mashed Potato Bread and Butter Apple Pie
Friday	Muffins. Cereal Syrup. Coffee	Salad. Pudding Bread and Butter	Pork Chops Potatoes. Tomatoes Bread and Butter Custard
Saturday	Hot Cakes, Syrup Cereal. Coffee	Potato. Apples Onion Salad Rice and Cream Bread and Butter	Roast Pork Baked Potatoes Creamed Onion Gravy Bread and Butter Cream Cake. Coffee
Sunday	Fried Mush Toast	Bread and Butter Fruit. Cake	Veal Roast, Fravy Baked Potato Creamed Onion Bread and Butter Cream Cake. Coffee

Table No. 7 gives the cost by meals of one week's cooking on the coal range, the water front being disconnected.

Table No. 7

Coal Range, Water Front Disconnected

Pounds

	Breakfast		Lunch		Dinner	
Day	Wood	Coal	Wood	Coal	Wood	Coal
Monday	3.00	8.00	2.00	6.00	3.50	6.00
Tuesday	3.00	5.00	2.25	6.00	3.00	6.50
Wednesday	4.00	4.00	3.00	4.50	3.25	6.25
Thursday	3.00	6.50	4.00	7.00	5.00	9.00
Friday	3.00	2.75	2.00	2.75	2.50	6.00
Saturday	2.00	1.75	0.00	2.00	5.75	5.00
Sunday	3.75	5.25	1.50	5.00	1.50	3.00
Total pounds	21.75	33.25	20.75	33.25	24.50	46.75
=Cost (cents)	6.5	16.6	6.2	16.6	7.35	23.4
Total	23.1		22.8		30.8	
Cost per meal	3.3		3.25		4.4	

Total cost for week ..... 76.7 cents

Average cost per meal ..... 3.65 cents

=Value of 1 pound of wood, .3 cents; pound of coal, .5 cents.

Table No. 8 gives the cost by meals of a week's cooking on the coal range with the water front connected.

Table No. 8
Coal Range—Water Front Connected
Pounds

	Breakfast		Lunch		Dinner	
Day	Wood	Coal	Wood	Coal	Wood	Coal
Monday	5.50	4.50	6.50	9.50	3.75	9.75
Tuesday	3.75	6.50	9.25	7.00	6.00	7.50
Wednesday	6.00	9.00	5.50	4.25	5.50	3.25
Thursday	4.00	2.00	9.00	9.75	9.00	9.75
Friday	4.50	9.75	4.50	5.00	5.50	13.50
Saturday	6.75	5.50	6.00	11.50	3.75	11.25
Sunday	9.25	15.25	5.00	0.00	3.00	18.00
Total pounds...	39.75	52.50	45.75	47.00	36.50	73.00
Costs in cents..	11.9	26.25	13.7	23.5	10.95	36.5
Total cents ...	38.15		37.2		47.45	
Cost per meal..	5.45		5.3		6.78	
Total cost for week.....						$1.23
Average cost per meal.....						5.85 cents

In all three weeks' cooking was done on the coal range with the water front disconnected, four weeks with the water front connected and five weeks with the electric range. Table No. 9 gives the average costs per week and per meal of this work.

Electric Surface Meat Roasting Ovens at Sacramento, California

Table No. 9

Equipment	Average Cost Per Week	Per Meal
Coal range, W. F. connected.....	119.6c	5.70c
Coal range, W. F. disconnected.....	77.4c	3.67c
Electric Range	78.5c	3.72c

The results speak for themselves in general, but it might be pointed out from Table 8 that with the coal range it costs very nearly the same to cook breakfast or lunch as to cook dinner, while from Table No. 5 it is seen that the cost for breakfast, the lightest meal, is about half the cost of dinner. Also, from Table No. 9 it is seen that it costs 42.2 cents per week to heat the water for domestic use with the water front on the coal range.

The writer realizes fully that the amount of data presented is far too small to justify the making of any very sweeping inferences, but at the close of the coming year he hopes to have very complete results.

In conclusion the writer wishes to express his best thanks to Mr. M. C. Osborn and to Mr. L. W. Kingsbury, both of the Washington Water Power Company, who have generously loaned equipment, and to Prof. Agnes Craig of the Home Economics department of Washington State College, who modified her plans at the Practice Cottage sufficiently to make possible the special cooking carried on there.

WATER POWER DEVELOPMENT IN NORWAY

Among the important companies that are utilizing the falls of the Bergen district for the development of power may be mentioned:

1. A/S Hoyanger. This concern was founded in 1915. It is capitalized at 10,000,000 crowns ($2,680,000), fully paid up on February 1, 1917. The company is harnessing 20,000 horsepower and has 60,000 in reserve. It will manufacture aluminum, the raw materials to be imported from France, where the company has a controlling interest in deposits of bauxite. It is calculated that 3000 to 4000 tons of crude aluminum will be delivered a year.

The plant is partly equipped, the equipment being largely of German manufacture. Dr. Emil Collett and Mr. S. Kloumann, engineer, are the managing directors, with offices in Christiania.

2. A/S Osa Fosse Co., office at Bergen. Mr. Albert Nostrand, Bergen, is the managing director.

This company's plant is in the preparatory stage. The waterfall is 800 meters (meter = 3.28 ft.) high. The falls represent about 80,000 h.p., possibly 100,000; about 40,000 is being developed. The situation is very good, but in cold winters the harbor is closed by ice. The company is closely connected with Bergens Zinc Smelting Company, which will use a small part of the power.

The concern has a working capital of 6,000,000 crowns ($1,608,000), of which one-half is fully paid.

3. A/S Bremanger Kraftselskab, of which the managing director is Mr. Kristen Faye, Bergen, is capitalized at 3,000,000 crowns ($804,000). This company's plant is still in the preparatory stages. It is situated close to the sea at Sondfjord, north of Floro, and will have good facilities for ships and all necessary buildings for employes.

The falls, which are 475 meters high, will develop 30,000 h.p. They can be developed for alternating current. It is the intention to manufacture calcium carbide and ferrosilicon and some cyanamid.

Both this company and the one just described expect to have development finished in about three years.

4. A/S Bjolvefossen (at Indre Aalvik, on the Hardangerfjord) is capitalized at 8,500,000 crowns ($2,278,000), fully paid up. Dr. Thorvald Heiberg, Christiania, is the managing director. The waterfall is about 800 meters high. The company has 20,000 horsepower in use and is developing 44,000. It manufacturers carbide and cyanamid. The plant is partially equipped with machinery that has come largely from Germany.

Turbines in electric water power development are obtained from Switzerland and Sweden furnishes other goods, but in the main equipment will have to be obtained from either Germany or the United States. At the present time freights are too high and delivery of goods too slow and uncertain for rapid progress to be made in completing these plants, and after the war it is believed German firms will put forth strenuous efforts to get this trade. Hydroelectric development will doubtless make great strides on the west coast after the war.

SELLING THE ELECTRIC RANGE

BY S. M. KENNEDY, J. F. ROCHE AND A. C. COONRADT

(Policies and methods in the sale of electric ranges are being rapidly formulated as the result of recent experience. This paper summarizes the opinion of several authorities who have been signally successful in building up this class of business. It constitutes a part of the report of the range committee to be presented at the September convention of the Northwest Electric Light and Power Association.—The Editor.)

The electric range has long since emerged from its experimental stage and is now thoroughly practical. It is no longer a luxury but a necessary convenience for the home. Thousands of ranges are installed in progressive households throughout the country. This proves conclusively that the electric range is not only equal but actually superior to any cooking appliance heated by gas, coal or wood and we can tell our customers that the electric range can do anything any other range can do and do it a little better.

The range should be sold at cost plus 15 per cent and a fixed added installation charge. Present statistics seem to warrant an installation charge, except in unusual cases, of $15, but as a matter of policy a fixed charge of less than $15 might be advisable. The wiring and installation charge should be included in the range price. The foregoing terms are based on cash sales. We advise a 10 per cent increase where payments are made by installments.

It is obvious that a complete assortment of ranges should be displayed at the office. Wiring should be so arranged that any of the ranges may be connected for demonstration. Each employe in offices where ranges are displayed, should understand intimately the construction and operation of a range so that in cases of emergency they will be qualified to handle a prospect with grace and efficiency. Invitations should be sent to a selected list of customers to witness periodical demonstrations held at the office.

Careful scrutiny should be given all announcements of public or semi-public gatherings, and arrangements made in advance to supply and demonstrate electric ranges on all such occasions. From time to time it is advisable for the company to conduct a cooking school at a location other than the office. Many of the large manufacturers of food products employ traveling demonstrators and arrangements may be made with these demonstrators to use an electric range, thereby making the demonstrations of mutual advantage.

Good prospects for home calls may be obtained from the office records of those who have manifested an interest in the ranges on display in the office.

Competent women demonstrators should be detailed to visit the homes of new range customers immediately after the ranges have been installed. The customer should be impressed with the idea that future demonstrations will gladly be given upon request. Calls should be repeated until it is assured that the operation of the range is thoroughly understood and that it is working satisfactorily.

Co-operation with the electrical contractor dealer is essential. They should be encouraged by allowing them to do the wiring when practical. If dealers are to do the wiring for ranges a set of standard wiring and installation specifications should be supplied by the central station and sent to all dealers and contractors. These specifications should be strictly adhered to as the range can not operate successfully otherwise.

While it is desirable that we should co-operate with dealers as much as possible, the dealers and contractors should remember that it is the paramount duty of the central station operators to build up their business for the benefit of the stockholders. While the electric range is coming into universal recognition, it is necessary for the central station to assume a large expense for promotion work. Range prices as well as all other materials are advancing rapidly, thus greatly curtailing sales. We believe that for the present central stations must assume the undesirable burden of selling the ranges and in most instances of doing the wiring and installing. As the business develops the time will gradually come when dealers can more profitably take over the range business.

Some one has said, "When destiny can't win a man any other way, she always sends a woman and has never failed to land him." Nothing will win the good will of a woman more quickly than a convenient home equipment, coupled with golden rule service. That kind of things will win the confidence of the woman of the home and obtain her good will, to which the reasonable husband will and must agree. The electric range is the last word in domestic convenience.

UNDERGROUND WATER IN NEVADA DESERTS

In Nevada the bedrock forms a corrugated surface consisting of more or less parallel mountain ranges and broad intervening troughs that are filled to great depths with rock waste washed from the mountains. These great deposits of rock waste were in large part laid down by torrential streams and are relatively coarse and porous. Because these deposits are porous the rain that falls upon them and the run-off that reaches them from the mountains sink into them, and the valleys in which they lie are exceptionally arid. These deposits, however, form huge reservoirs in which the water is stored, and in which, to the limit of the capacity of the reservoirs, it is protected from evaporation.

In a desert valley, even where no wells have been sunk, it is generally possible to ascertain and outline the areas where ground water lies near the surface and to make an intelligent forecast of the depth to water in other parts of the valley. If a sufficient number of observations are made it is also generally possible to form a rough estimate of the quantity of water that is annually available in such a valley and to predict to some extent the capacity of wells, the quantity of the water, and the cost of recovery.

FEEDER DIVERSITY OF ELECTRIC RANGES

BY H. B. PEIRCE

(The effect that a load of electric ranges has on a given lighting feeder is a question of growing importance in the West where electric cooking is receiving such pronounced attention. Here are the results of an investigation on this subject by the assistant commercial agent of the Washington Water Power Company at Spokane that should prove of timely value to commercial agents throughout the West. The article has been prepared for consideration at the Spokane convention of the Northwest Electric Light & Power Association.—The Editor.)

In previous discussions of the Electric Range and its diversity, attention has been principally directed to the diversity or demand factor of a group of ranges with respect to its relation to the income of the central station at the main bus bars.

It will be the purpose of this paper to pay more particular attention to the effect a load of electric ranges has on a given lighting feeder; this is, for the larger cities, the more important question today, particularly so as, in these parts of the country, where hydraulic power is available, it is the primary duty of the engineer to keep down plant investment and as it will be some time before our range peaks cause us to experience station peaks requiring additional investment in generator capacity, it will be more profitable to consider first the problem that immediately confronts us, of having to either provide for heavier feeders or for a larger number of feeders, to handle certain sections where the electric range is threatening to establish the peak of the feeder.

In connection with any such discussion, it will not be out of place to point out what can be done to make the individual feeders more efficient.

To observe the effect of electric ranges on feeders in Spokane, a set of six feeders was selected for special observation. As the city is geographically divided into two sections, north and south, three were selected for each. These were not selected at random but were taken as follows:

1st. One heavily loaded with ranges without other distributing power load;

2nd. One of medium range density, without other abnormal condition;

3rd. A feeder as nearly free from ranges or other power load as could be found.

All of these feeders supply residential districts, with practically no stores or shops to be considered. Each feeder is laid out to handle approximately 100 amperes at 2300 volts single phase. Many, for geographical reasons, have maximum peaks short of this, but this is the amount of peak originally contemplated.

By installing Bristol ammeters and watt-hour meters on each feeder, it was thought data of interest could be secured.

Table No. 1

Feeder Number Location	2543 Brown's Addition	2527 Cannon Hill	2146 Sacred Heart	2140 Natatorium Park	2147 Corbin Park	2531 Gonnzaga College
Number of Ranges	13	39	13	21	11	6
Peak in Amperes						
Saturday 1-13-17	76— 6:00	76— 5:55	81— 6:00	79— 6:05	94— 6:05	23— 5:35
Sunday 1-14-17	66— 6:35	47— 6:30	65— 7:15	66— 5:55	89— 7:05	20— 6:30
Monday 1-15-17	79— 5:35	84— 5:55	86— 5:50	83— 5:40	101— 5:45	25— 5:40
Tuesday 1-16-17	81— 5:40	82— 5:55	87— 5:50	85— 5:35	100— 5:40	23— 5:50
Wednesday 1-17-17	81— 6:00	76— 5:55	89— 6:00	79— 6:05	101— 5:50	24— 5:45
Thursday 1-18-17	81— 5:50	80— 5:55	84— 5:55	83— 6:05	106— 5:40	25— 5:50
Friday 1-19-17	85— 5:45	80— 5:40	90— 6:00	84— 5:45	95— 5:45	32— 5:45
Saturday 1-20-17	81— 5:50	76— 6:00	77— 6:00	82— 5:45	93— 5:55	32— 6:10
Sunday 1-21-11	71— 7:05	59— 6:10	60— 6:45	66— 5:45	71— 5:50	23— 6:00
Monday 1-22-17	85— 5:45	75— 5:50	87— 5:50	83— 5:45	90— 5:35	30— 5:45
Tuesday 1-23-17	82— 5:50	77— 5:05	84— 5:50	84— 5:50	89— 5:55	32— 5:30
Wednesday 1-24-17	81— 5:40	80— 5:50	81— 5:50	79— 5:50	94— 5:45	33— 5:45
Thursday 1-25-17	75— 6:00	75— 6:00	82— 5:50	79— 5:40	87— 7:25	32— 5:45
Friday 1-26-17	78— 5:45	84— 6:00	82— 6:15	80— 5:50	88— 5:45	33— 5:45
K.w.-hr. 1st week.....	12,300	10,800	11,200	11,600	14,800	4,080
Kw.-hr 2d week.....	11,700	10,850	11,200	11,200	12,400	4,640
Total kw.-hr.....	24,000	21,650	22,400	22,800	27,200	8,720
Load Factor—						
First week	41.6	36.9	35.8	38.2	40.1	36.6
Second week	39.5	37.2	37.0	36.6	37.9	40.4
For two weeks	40.6	37.1	35.8	38.5	36.8	37.9

Table No. 2

Feeder Number Location	2543 Brown's Addition	2527 Cannon Hill	2146 Sacred Heart	2140 Natatorium Park	2147 Corbin Park	2531 Gonnzaga College
Number of Ranges	13	53	17	25	17	6
Peak in Amperes						
Saturday 6- 2-17	51— 8:40	56— 8:30	53— 8:40	95— 8:50	56— 8:50	26— 8:55
Sunday 6-3-17	44— 9:30	52— 8:55	49— 8:50	79— 8:35	51— 8:50	23— 8:40
Monday 6- 4-17	51— 8:45	53— 8:30	55— 8:30	92— 8:20	55— 8:30	23— 8:15
Tuesday 6- 5-17	49— 8:40	57— 8:50	51— 8:50	94— 8:50	50— 8:50	23— 9:00
Wednesday 6- 6-17	50— 8:50	54— 8:15	64— 8:40	95— 9:05	53— 8:45	26— 8:50
Thursday 6- 7-17	50— 9:10	51— 9:00	54— 8:55	89— 9:00	49— 8:50	23— 9:00
Friday 6- 8-17	47— 8:55	52— 8:45	52— 8:50	91— 8:50	51— 8:50	26— 8:40
Saturday 6- 9-17	46— 9:25	56— 9:10	45— 8:55	92— 8:40	48— 8:55	25— 8:50
Sunday 6-10-17	52— 9:15	50— 8:45	55— 9:10	84— 8:50	52— 8:50	23— 9:00
Monday 6-11-17	51— 8:55	53— 9:10	53— 8:40	97— 8:35	47— 8:30	26— 9:10
Tuesday 6-12-17	47— 9:10	51—11:50*	47— 9:10	93— 8:50	47— 9:15	24— 9:00
Wednesday 6-13-17	47— 9:15	49— 9:05	50— 8:55	93— 9:00	47— 9:15	23— 9:15
Thursday 6-14-17	44— 9:15	48— 9:00	45— 9:15	92— 8:55	46— 9:20	23— 9:00
Friday 6-15-17	42— 9:15	48— 9:35	40— 9:20	89— 9:20	45— 9:35	22— 9:25
Note.—All time of peak P.M. except * which is A.M.						
Kw.-hr. second week.....	5,440	8,300	7,600	9,200	6,000	2,560
Kw.-hr. first week	6,640	9,000	7,600	9,600	6,000	2,560
Total kw.-hr.	12,080	17,300	15,200	18,800	12,000	5,120
Load Factor—						
First week	36.3	45.4	34.1	27.8	30.7	28.3
Second week	30.2	42.5	39.7	28.5	33.2	28.3
For two weeks	33.4	43.7	34.1	27.9	30.7	28.3

The first set of observations was taken in the middle of winter to determine, if possible, to what extent seasons influenced such load factors. A similar set of readings was again taken in summer, to supplement the first set. The results are shown in Table No. 1 and Table No. 2.

The kilowatt-hours observed are open to question as the instruments were rather large for the purpose, so that too much must not be assumed from the load factors given at the bottom of each column.

It will also be noted that no attempt is made to measure the range demand factor or diversity; this would have been well-nigh impossible and as the effect of ranges on load factor is what is really most interesting, computation of diversity is to a certain extent unnecessary.

The term "load factor" should probably be qualified in this case, as the maximum demands from which the load factors are computed are measured in kilo-volt-amperes and power factor arbitrarily assumed at 90 per cent. But as all of the feeders have approximately equal power factors, and as these results are not to be considered as highly accurate, the load factors given are sufficiently definite for comparison.

It will be noted that feeders with a small number of ranges show decreasing load factors as summer approaches, while the feeders with a larger number of ranges show increasing load factors. One exception would appear to be feeder No. 2140, but as this feeder has an amusement park on it during the summer months, and was considerably altered in the spring, it is not typical.

In order to give more accurate information on the feeders with considerable range load, feeder No. 2527 was further analyzed by being equipped with more accurate recording ammeter and by rectifying the Bristol ammeter charts; on these rectified charts the average daily load has been measured by planimeter and laid off for comparison (see Figures 1, 2, 3, 4, 5, 6 and 7). The characteristics of the feeder are as given below:

Feeder No. 2527.—This feeder supplies a quarter of town located in the southern part of Spokane and made up of small frame houses of an average size of 8 or 9 rooms, with a few large houses and one apartment house, the latter with its eight 6-room apartments, each with electric range, being the largest single consumer on the feeder. The homes are mostly occupied by families of the better grade of office and professional men, the average income probably being about $2400 per year.

Residence Data

Total number of residences	613
Total number of electric ranges	53
Total capacity connected in ranges	303.3 kw.
Total number of electric water heaters	29
Total capacity, electric water heaters	21.65 kw.
Total number of transformers	44
Total capacity, transformers	437.5 k.v.a.

Daily Load Data

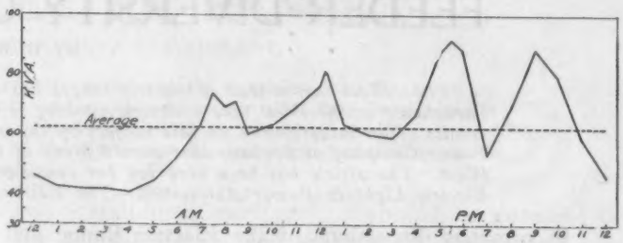
	Average k.v.a.	Maximum k.v.a.
Sunday	59.0	109.7
Monday	62.2	91.7
Tuesday	69.3	107.0
Wednesday	68.4	107.5
Thursday	61.8	97.3
Friday	63.7	111.2
Saturday	66.3	112.0

Average, 64.4.

Weekly apparent load factor, 57.5 per cent.

It will be noted that it is characteristic of these curves that there is a night load of something over 40

DAILY LOAD CURVES



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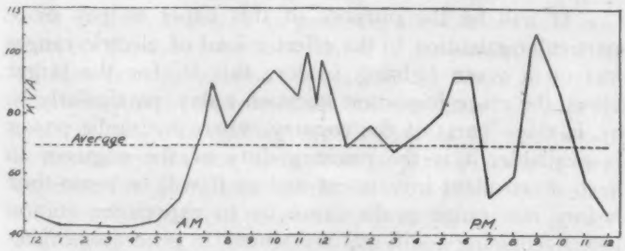

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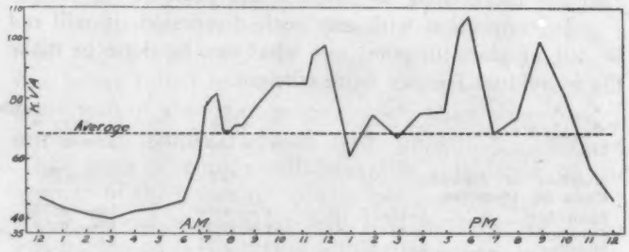

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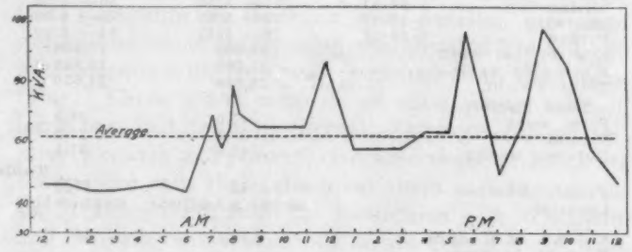

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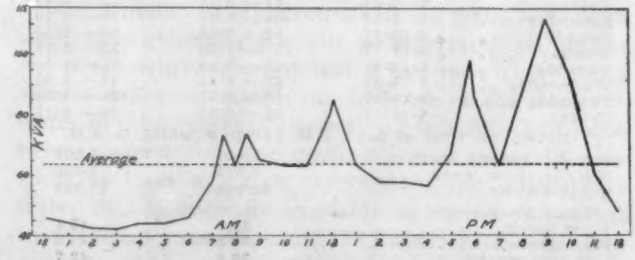

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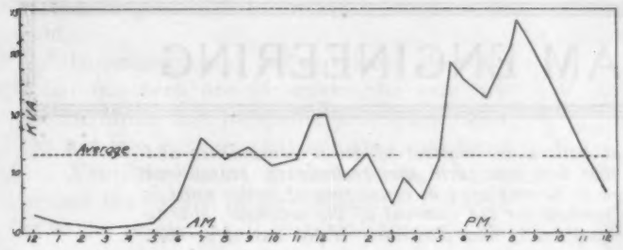

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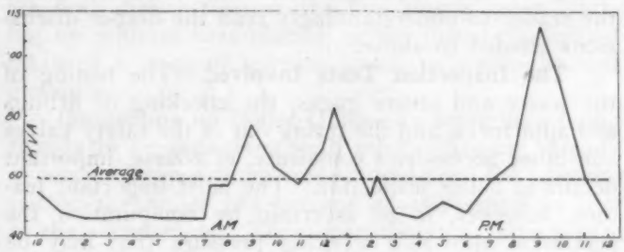


Sunday

k.v.a. on every night and that the valley between the 6 o'clock peak and the 9 o'clock peak approaches the same minimum. This can be accounted for by the water heater load which is practically entirely off the range peaks, as each water heater is on a control switch that prevents its being used when the oven of the range is alive. This water heater load, therefore, accounts for over half of the 40 k.v.a.; the balance is made up of all-night lighting and feeder losses, transformer iron losses and meter losses.

Deducting this 20 k.v.a. with an additional 20 k.v.a. for lighting from the largest range peak, 107.5 k.v.a., we get a net range peak of 67.5 k.v.a. at 6:00 p. m. Wednesday which, compared with the connected load of 303.2 k.v.a. in range capacity, gives a demand factor of 4.5, checking with the results formerly secured by the author (see A. I. E. E. Proceedings, August, 1916, page 1213), which would indicate that with 53 ranges, the poorest demand factor probably would be 4.2.

Now to consider the effect of our feeders in the near future.

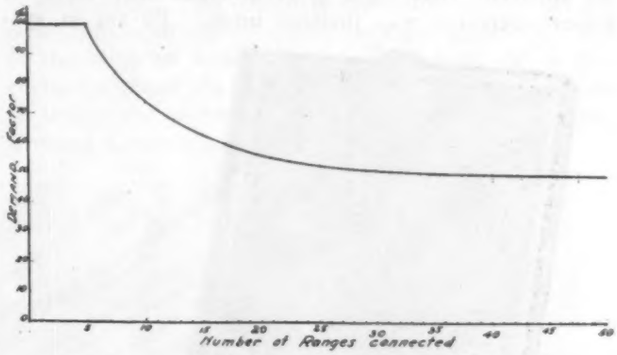
It is estimated that in a very few years the territory now fed by this one feeder will have six times the present range density, that is, 318 ranges with 1820 k.v.a. connected. Should this be handled by six distinct feeders at present capacity, it is clear that the characteristics of the feeders would be quite similar to those of the feeder now supplying the territory, with the exception that the lighting and ironing peaks would be about 1.6 as large as at present. The annual peak would occur in winter, when the range peak and lighting peak coincide.

The winter peak for this feeder was 193.2 k.v.a., with 39 electric ranges, which with 3.9 demand factor (see A. I. E. E. Proceedings, August, 1916) would mean a maximum range load of 60 k.v.a., leaving 133.2 k.v.a for lighting and losses.

Taking one-sixth of this, there will be little improvement in diversity of lighting due to decrease in number of consumers. We get a lighting and loss load of 22.2 k.v.a. and a superimposed peak of 67.5 k.v.a., due to ranges giving a total of only 89.7 k.v.a. for the annual maximum demand of the feeder, less than half its capacity.

Taking one-third of the district to a feeder, we would have a lighting and losses load of 44.4 k.v.a., which, with a load of 106 ranges of 607 k.v.a. capacity and demand factor 4.7, would be increased by 129.1 k.v.a. to a load of 173.5 k.v.a., which is within the capacity of the feeder.

If we go a step further and use only one additional feeder, we find that our lighting and losses load becomes 66.6 k.v.a. and our 159 ranges, with 910 k.v.a. of capacity and demand factor of 5.2, gives a total peak of 241.6 k.v.a., which a feeder of slightly larger size and only slight additional expense could handle.



The Demand Factor Curve for Determining the Size of Electric Range

In other words, it would appear that while all of our data is still far too inaccurate to make any very definite predictions, still, insofar as feeders are concerned, the excellent diversity of the electric range will make it possible to handle very considerable loads with only slight increases in feeder investment.

MAKING THE DESERTS ACCESSIBLE

In recent years the water supply geologists of the Geological Survey have developed trustworthy methods of located ground water in arid regions from surface indications and estimating the depth to water and the approximate annual yield of the underground reservoir. These methods will be applied and further developed in connection with the survey of desert watering places.

FUEL CALORIMETER TABLES

A new publication of the Bureau of Standards, (Circular No. 65) entitled "Gas Calorimeter Tables," has just made its appearance.

This circular may be regarded as a supplement to Bureau of Standards Circular No. 48, "Standard Methods of Gas Testing." The correction tables are arranged in a sequence most convenient for use in connection with the proposed record sheet. The record forms for calorimeter tests which are shown in the circular have been used for some time and found to be complete and convenient. It is hoped that these forms will be adopted wherever possible so that there will be greater uniformity in operating methods and the records used.

FUEL OIL AND STEAM ENGINEERING

(Simple rules for the putting in and putting out of boilers are matters of much convenience and importance in fuel oil practice. Here is a discussion that first sets forth the preliminary precautions necessary to be taken by the engineer, then the method to be employed in connecting up boiler units is given. The discussion closes with the description of a method for the removal of the sediment, how to keep out cylinder oil, how to cool and clean the boiler, and finally how the boiler is put out of service. —The Editor.)

BOILER ROOM INSTRUCTIONS FOR FUEL OIL BURNING

BY ROBERT SIBLEY AND CHAS. H. DELANY

Many fatal accidents both to life and property have happened due to foolhardy methods in design and operation of the steam boiler. This early became so apparent that rigid governmental inspection of boiler operation was insisted upon. To aid in systematic inspection the Department of Commerce and Labor at Washington has issued general rules and regulations for such supervision under Form 801 entitled Steamboat Inspection Service. Many insurance companies have, too, put into force rigid rules of inspection to safeguard their interests in assuming risks. The most complete publication on the subject, however, is to be found in the recently published report of the Boiler Code Committee of the American Society of Mechanical Engineers, entitled: "Rules for the Construction of Stationary Boilers and for Allowable Working Pressure." These rules have been adopted by law in a number of States, including California where they have been incorporated in the Safety Orders of the State Accident Commission.

AN INSPECTOR'S TESTING AND PROVING OUTFIT
Here is a typical outfit for boiler and power plant inspectors. It consists of a standard test gauge, a screw test pump, a gauge hand puller, a hand set and other useful conveniences.

In the discussion taken up in this chapter only fundamentals will be considered. The thorough mastering of these fundamentals will, however, enable the reader to understandingly read the deeper discussions alluded to above.

The Inspection Tests Involved.—The testing of the water and steam gages, the checking of fittings and appliances, and the trying out of the safety valves and other accessories constitute, of course, important details of boiler inspection. The most important feature, however, is to ascertain by computation the maximum allowable working pressure that may be safely put upon the boiler. After this maximum allowable pressure is ascertained the boiler is subjected to a hydrostatic pressure test by filling the boiler completely with water and then pumping enough additional water into it to raise the pressure to the desired point. This apparatus is held under proper control and the total pressure put upon the boiler is one and one-half times the maximum allowable working pressure.

Thus if the maximum allowable working pressure on a boiler is 160 lbs. per square inch above the atmosphere, the test pressure to be applied should be 240 lbs. per square inch.

Many carefully compiled instructions have from time to time been issued by various boiler makers, inspectors, and others interested in economic and safe operation. The instructions compiled by J. B. Warner, chief inspector of the San Francisco department of the Hartford Steam Boiler Inspection and Insurance Company are especially good, and largely the ideas appearing in the following lines come from this source:

Preliminary Precautions.—Whenever going on duty in the boiler room, find out, first of all, where the water level is in the boilers. Never lower nor replenish the fires until this is done. Make sure that the gage glass and gage cocks, and all the connections thereto, are free and in good working order. Do not rely upon the glass altogether, but use the gage cocks also, and try them all, several times a day.

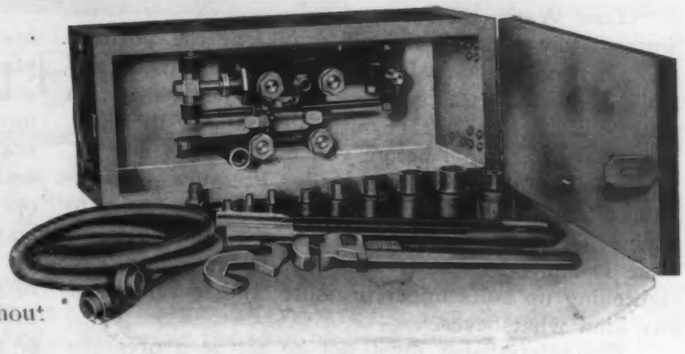
Before starting up the fires, open each door about the setting and look carefully for leaks. If leaks are discovered, either then or at any other time, they should be located and repaired; but cool the boiler off first. If leaking occurs at the fore and aft joints, the inspecting company should be notified at once. This is important, whether the attendant considers the leakage serious or not; and it is especially important when the boiler has a single bottom sheet, or is of the two-sheet type.

When a boiler has been emptied of water, do not fill it again until it has become cold.

In preparing to get up steam after the boiler has been out of service, be sure that the manhole and handhole joints are tight. Do not use gaskets that are thin and hard.

Vent the boiler in some way, first, to permit the escape of air. Then fill the boiler to the proper level, open the dampers, and start the fires. Start them early so as to have the pressure up at the required hour, without forcing.

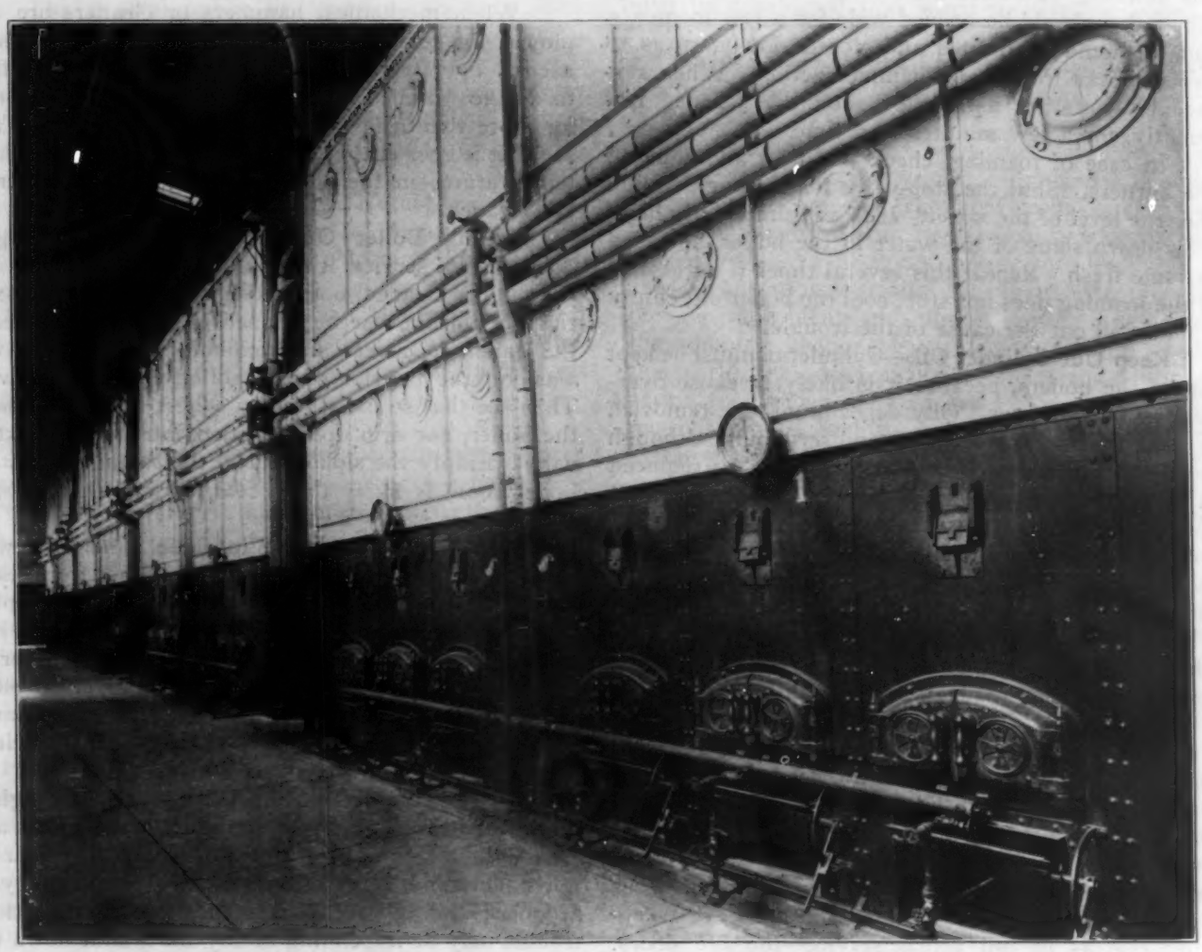
Ventilate the setting thoroughly before lighting the fire. Never turn on the fuel supply when starting up without first placing in the furnace a lighted torch or a piece of burning waste to ignite the fuel instantly.



A PORTABLE BOILER TEST PUMP

After the maximum allowable working steam pressure for the boiler has been computed, the boiler is then submitted to a hydrostatic test of one and one-half times this allowable pressure. The above apparatus is especially adapted for those having frequent occasion to make hydrostatic tests of boilers.

Connecting up Boiler Units.—In firing up a boiler that is to be connected with others that are already in service, keep its stop-valve closed until the pressure within the boiler has become exactly equal to that in the steam main. Then open the stop valve a bare crack, and slowly increase the opening until the valve is wide open. The complete operation should occupy two minutes or more. Close the valve at once if there is the slightest evidence of any unusual jar or disturbance about the boiler. See that the steam main to which the boiler is to be connected is thoroughly drained before the valve is opened.



TYPICAL BOILER FRONT WITH AUTOMATIC REGULATOR

Here may be seen a recent improved system for regulating the fuel that is fed to the boiler furnaces. The installation is that of the Inspiration Copper Company's plant, described in the Journal of Electricity, August 15, 1917, page 149. The oil supply is controlled from one central point, and with it, the steam used, in atomizing the oil and the quantity of air admitted to the furnace are also under delicate control. Any fluctuation in steam pressure operates a governor whose power arm controls a bleeder valve on the oil pump discharge line thus cutting off the oil supply, if the steam pressure is too high and reducing it, if too low. Any change in pressure in the oil main, in turn, controls the amount of steam for atomizing and of air for burning the oil.

Low Water Encountered.—In case of low water, immediately shut iff the oil supply at the burners. Do not turn on the feed under any circumstances, and, do not open the safety-valve nor tamper with it in any way. Let the steam outlets remain as they are. Get your boiler cool before you do anything else.

Avoid Making Repairs Under Pressure.—No repairs of any kind should be made, either to boilers or to piping, while the part upon which the work is to be done is under pressure. This applies to calking, to tightening up bolts under pressure, and to repairs of any kind whatsoever.

The safety-valve must not be set at a pressure higher than that permitted by the insurance company's policy. Try all safety-valves cautiously, every day. If the actual blowing pressure, as shown by the gage, exceeds the pressure at which the valve is supposed to blow, inform the office immediately, so that prompt notice may be sent to the company. The safety-valve pipe should never have a stop-valve upon it.

Removal of Sediment.—To remove sediment from the bottom of the boiler, open the blowoff valve in the morning, or before the circulation has started up. The valve should be opened wide for a few moments, but it should be opened and closed slowly, so as to avoid shocks from water-hammer action. When surface blowoffs are used, they should be opened frequently, for a few minutes at a time.

In case of foaming, check the draft and shut off the burners. Shut the stop-valve long enough to find the true level of the water. If this is sufficiently high, blow down some of the water in the boiler, and feed in some fresh. Repeat this several times if necessary. If the foaming does not stop, cool the boiler off, empty it, and find out the cause of the trouble.

Keep Out Cylinder Oil.—Cylinder oil must be kept out of the boilers, because it is likely to cause overheating of the plates. Oily deposits may be removed, in large measure, by scraping and scrubbing, although more efficient methods of treatment may be required in bad cases. If kerosene is used in a boiler, keep all open lights away from the manholes and handholes, both when applying the kerosene, and upon opening the boiler up afterwards; and ventilate the inside of the boiler thoroughly, after oil has been used in it.

Fusible plugs should be filled with pure tin. They should be renewed or refilled as often as may be necessary to keep them in good condition.

Cooling and Cleaning the Boiler.—In cooling a boiler before emptying it, first let the fire die out, and then close all doors and leave the damper open until the pressure falls to the point at which it is desired to blow. Clean the furnace and let the brickwork cool for a least two hours before opening the blowoff valve. If it is desired to cool the boiler further, after it has been emptied open the manhole and leave everything else as in full actual service—the fire doors, front connection doors, and cleaning doors being closed, and the damper and ash-pit doors open.

First cool the boiler as explained in the last paragraph. Never blow out under a pressure exceeding ten or (at most) fifteen pounds by the gage.

The engineer must find out for himself how often his boilers need to be opened and cleaned. In many plants it is necessary to clean every week, while in some favored few it is sufficient to clean every three months. When using kerosene or large amounts of scale solvent, or when (as in the spring-time) the water becomes unusually soft, the boilers must be opened oftener than usual. In washing out a boiler, wash the tubes from above, as well as from below.

Never touch any valve whatsoever, in any part of the room, while a man is inside of a boiler, nor even after he has come out again, until he has reported that his work is finished and that he will not enter the boiler again. It is well to lock the stop-valve and blowoff valve upon every boiler in which a man is working, while other boilers are under steam. Padlocks and chains may be used for this purpose.

In water-tube boilers the covers opposite the three rows of tubes nearest the fire should be taken off once a month, and the tubes thoroughly scraped and washed out; and all the tubes should be thoroughly scraped and washed out at least once in four months. This is for water of average quality. If the water is bad, clean the tubes oftener.

When mechanical hammers or cleaners are employed for removing scale from tubes, the pressure used to operate them should be as low as will suffice to do the work. Do not allow the cleaner to operate for more than a few seconds upon any one spot, and see that it goes entirely through the tube. Avoid high temperatures in the steam or water used to operate the cleaner.

Putting Boiler Out of Service.—In putting a boiler out of service, it should be cooled, emptied, and thoroughly cleaned, both inside and outside. The setting should likewise be cleaned in all its parts. Leave the handhole covers and manhole plates off. After washing the interior of the boiler, let it drain well. Then see that so moisture can collect anywhere about the boiler, nor drip upon it either internally or externally. Empty the siphon below the steam gage if the boiler room is likely to be cold, or take the gage off and store it safely away.

Do not allow moisture to come in contact with the outside of the boiler at any time, either from leaky joints or otherwise. Keep the mud drums and hipples, and the rear ends of horizontal and inclined tubes in water-tube boilers, free from sooty matter. If internal corrosion is discovered, notify your employers at once.

Examine your boilers carefully in all their parts, whenever they are laid off, and keep them as clean as possible, both inside and outside. See that all necessary repairs are made promptly and thoroughly. Keep the water glass and pressure gage clean and well lighted. If any contingency arises that you do not understand, report the matter to your employers at once; and if you think it possible that serious trouble may be impending at any time, shut down the boiler immediately.

Inform yourself respecting any local laws or ordinances relating to the duties of engineers and firemen, or to the plant in which you work. If there be any such, attend to them faithfully.

SPARKS—Current Facts, Figures and Fancy

(A spark is a brilliant flash of light that is often observable when gigantic electrical energies are brought into play. Here are sparks emanating from the energies of a gigantic industry that may perhaps serve to give you a new thought or add new inspiration to the work you have at hand.—The Editor.)

The annual price paid for street lamps in a number of prominent cities of the nation is as follows: Seattle, $80 per arc lamp per year; Portland, $51.60; Butte, $61; Chicago, $75; Spokane, $48; San Francisco, $67.50, and Buffalo, two plants average $63.

* * *

Between the rails of a railroad there are, ordinarily, just four feet eight inches and a half, and the balance of the unsafe space does not exceed three feet; yet with all the rest of the world to stand and walk on, some 11,000 people every year find it necessary to their employment to end their days or their health, on this narrow strip of land.

* * *

The general public in America can draw some satisfaction that at least increases in electric traction rates is not proposed to the extent of recent orders in Russia where the Provisional government at Moscow has decided to increase passenger tariffs on the railroads 50 per cent and freight tariffs 200 per cent.

* * *

Some recent patents of Dr. Nernst relate to arcs struck between carbon electrodes in atmospheres of zinc, aluminium and titenium chloride. The latter appears to be specially suitable for the object in view. The efficiency obtained in such lamps is said to be similar to that obtained with mercury vapor lamps. A resistance in series with the arc is utilized to volatilize the salt used.

* * *

"Mrs. Frank J. Kerns used her automatic electric range to hatch chickens last week," so reports A. P. Tills, the commercial manager of the Northern Idaho & Montana Power Company. "Old mother hen refused to set longer on the eggs on account of the extreme hot weather. Mrs. Kerns immediately transferred the eggs from the nest to the oven on her electric range and to her surprise the next morning she had 14 little chicks. All are alive and doing well."

* * *

According to The Illuminating Engineer a new style of street light has been inaugurated in a Texas town which consists in placing a 100 watt lamp in an opal globe under the awning of each shop entrance. It was agreed that the system would not be applied to any block unless the entire block was uniformly lighted. About 400 lamps have already been installed, and it is stated that a good effect on the window lighting has also been produced, quite a number of prominent stores taking the opportunity to bring their illumination up to date.

* * *

Gas has been furnished at 7 and 7½ Dutch cents (2.8 and 3 American cents) per cubic meter (cubic meter = 35.3 cubic feet), but it is found that the actual cost of production is more than the charge to consumers. Therefore the price will be advanced to 10 and 10½ Dutch cents (4 and 4.2 American) per cubic meter.

* * *

The enthusiast in the safety movement, according to the Bureau of Safety, is he who knows he is working along the broad, humanitarian lines. He is aware that safety does not consist of a few speeches, a splurge of ink, and a moving picture show. These things help, but they alone will not suffice to pull men from the careless "danger habit" of years. That takes time, thought and constant effort. Above all, it must be considered that when indifference comes in at the front door, safety flies out the window. This fact makes plain the need for constructive enthusiasm, which is simply enthusiasm plus brains.

* * *

As indicative of the increasing friendliness and world-wide wholesome respect for the new engineering ideals of America, comment from a recent editorial of the Electrical Review of London is most interesting: "We need not follow the details of the new organization, our aim is to focus attention upon the vast movements in progress in the United States, the complete change of attitude towards the rest of the world, the adoption of new ideas and motives of action, as typified in these great movements in engineering circles, and to suggest again that there is a lesson to be learned by us from them."

* * *

An engineering journal, speaking on contraction and expansion caused by the cold and heat gives the following interesting facts: The Brooklyn Bridge is twelve inches longer at 3 p. m. on a hot day than it is twelve hours later; the Eiffel Tower is eight inches higher in summer than in winter. The Washington Monument at Washington increases its height about two inches on a hot day; a battleship is more than six inches shorter in winter than in summer and an ironclad in the tropics is nearly a foot longer than her sister ship in a northern sea.

* * *

Prehistoric irrigation is now known to have existed upon the Mesa Verde National Park Reservation. What is known as Mummy Lake was never properly a lake, but a reservoir for prehistoric irrigation. The surrounding region was doubtless well farmed. The remains of the ancient ditches indicate a considerable activity, according to Dr. J. Walter Fewkes of the Smithsonian Institution. To date, however, no evidence of the electrically operated pump seems to have been uncovered.

JOURNAL OF ELECTRICITY

FOUNDED 1897

PUBLISHED SEMI-MONTHLY BY THE

Technical Publishing Company

Crossley Building, San Francisco

E. B. STRONG, President
W. M. DEMING, V. P. and Business Manager
ROBERT SIBLEY, Secretary and Editor-in-Chief
E. B. STRONG, Jr., Treasurer
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Single Copies, Current Month	each	.25

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Entered as second class matter at the San Francisco Post Office

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THE TEST OF PATRIOTIC SINCERITY

The Romans built massive cities of marble.

The more excellent of the marble structures were perfect and form fitting.

Those which were not perfect and form fitting were filled with wax to make them look perfect.

In time the perfect building became known as *sine cera*—without wax.

In our patriotic service for the nation, for our company and for each individual self, would it not be an excellent idea to examine our motives, as the old Romans examined their buildings, and see if they can in all cases pass this test of *sine cera* or, in the modern use of the word, to see if our motives, from the innermost analysis are in fact at all times *sincere*.

The Contractor and Dealer

The splendid results attained at the recent Santa Cruz convention of the California Association of Electrical Contractors and Dealers, coupled with the enthusiasm that is being shown in the forthcoming September gatherings of contractors and dealers in British Columbia, Washington and Oregon, point to but one conclusion—the unquestioned success of co-operative effort of this character.

The annual sales possibilities of the electrical industry as a whole reach almost inconceivable figures. The present sales approximate $700,000,000. What is then the most practical way of doubling this volume in advance of the normal growth and at the same time developing a stable, healthy, profitable situation in all branches of our industry? This is the problem not only before men of the industry in the West but throughout the entire nation.

To undertake this task an organized industry is required. Is our industry organized? In certain branches, yes; for example, the central stations and the jobbers have efficient, strong organizations.

Lack of proper retail distribution is one of the millstones about the neck of the industry. There are perhaps 25,000 concerns now engaged in retailing electrical merchandise, but, because of improper methods and in fact ills of many descriptions, many of these concerns are financially weak. Failures have been innumerable and they will continue with all that it means to those concerned until the dealer arouses himself from his lethargy and does his part.

The question of retail distribution must be solved or the present most unsatisfactory conditions to all the branches of the industry will continue.

The retailers, which comprise contractors and

dealers, need, therefore, a good strong organization comprising national, state and local sections. Such organizations can develop healthy growth in the industry beyond the normal growth and all the while they will be able to produce profit to the interests participating. This is the goal for which every well-wisher of the electrical industry is striving. Lining up the industry on the basis of what it means to each individual should appeal at this time as a movement deserving the hearty support of all.

There are in the main two methods by which the industry in the West can be vastly forwarded. First, the continued hearty and systematic support of broad-minded technical journals that are now doing such efficient work in spreading the gospel of co-operation throughout every nook and corner of the electrical industry, and second, a more earnest and systematic gathering into the local, state and national associations of all contractors and dealers that are actively engaged in business at the present time.

With these two weapons used to their highest and most impersonal value, directed solely for the benefiting of the industry as a whole, there will result a constructive and commercial success beyond the fondest dreams of those looking toward the betterment of the industry throughout the nation.

New Opportunities for Women

It is difficult to estimate the future possibilities of women in the electrical industry and other vocational opportunities throughout the West. Editorial comment was made in the Journal of Electricity for June 1, 1917, page 455, relative to the almost unbelievable activities that women are performing in the electrical industry in England at the present time.

The constant trend in evolution of vocational opportunities for woman, serving to broaden her field of endeavor, combined with the new tasks that must perforce be performed by her, due to the exigencies of the present world crises, make her scope of activity one of unique opportunity.

It is with unusual pleasure that the publishers of the Journal of Electricity announce to its readers that in the future its columns will be devoted to a new departure in technical journalism. A department devoted to the opportunities for woman and the part she is to play in the great engineering and industrial development of the future will be headed by Miss Clotilde Grunsky, medalist of the class of 1914 at the University of California and daughter of C. E. Grunsky, one of the best known consulting engineers of the nation. Miss Grunsky's entire time will be devoted to the activities of the Journal of Electricity in the capacity of Associate Editor.

Since graduation, her nationwide research investigation of vocational opportunities for women has gained for her an enviable recognition as an authority on problems connected with women in the industries. Her editorial writings on these subjects, combined with her helpful lectures before the young women students at Mills College during the past year, have proven exceptionally marked.

The Journal of Electricity and its publishers bespeak for her in this new departure in technical journalism the kindly assistance, and loyal support of its readers that have been given so generously to all of its former activities since the initiatory days of its publication—thirty years ago.

Progress in Railway Electrification

Ever since the electrification of the St. Paul Pass has been completed and put into successful operation in Montana and Idaho, engineers of the West have watched with intense interest the after developments that would follow due partially to the rapid trend of economic evolution in the art of electrification of railways but more especially due to the insistent demand on the part of the public.

That the St. Paul has under way the electrification of its line through the last of the great mountain ranges hardly a year after completion of its first zone is regarded among railway men as confirming the wisdom of the St. Paul management in this undertaking.

The St. Paul will spend several millions in the Cascades. The electrification from Othello, Wash., to Seattle and Tacoma will add 211 miles to the electric lines, making a total of 651 miles under operation from mountain water-generated power. This gives the St. Paul, in addition to being one of the longest railway systems, the distinction of being the longest electric railway in the United States and probably in the world.

Eight substations will be built in the new zone for delivery of the current to the railway, located at Taunton, Doris, Kittitas, Hyak, the east portal of the Snoqualmie tunnel, Cedar Falls, Black River junction and the Tacoma shops.

The continued glowing reports from all those who have traversed the mountain passes of the West over this superbly electrified road lead thoughtful men to two conclusions—that railway electrification over the mountain passes has come to stay and that the real question is how best to finance undertakings of such gigantic proportions so that electrification may receive universal application throughout this section of the country.

The Financial Status of the West

Upon the financial stability of the West much depends for future industrial and commercial development, especially in hydroelectric activity. It is intensely gratifying to all well-wishers of the West to note the increasing share of financial responsibility that is being borne by the financial institutions of this section.

It is well-known that the engineering and commercial future of the countries bordering the great Pacific Area will look to America for an increasing support in enterprises of internal development. This conclusion is forcefully set forth in a recent report by P. S. Smith, a special agent of the Bureau of Foreign and Domestic Commerce who is in South America investigating opportunities for trade with our Latin American neighbors in electrical goods. In his report Mr. Smith states that if any big development

in our electrical export trade is to take place on the west coast of South America it will come as a result of the investment of American capital in mines, railways, electric companies and general mercantile stores, which will be truly American selling agencies, and not jobbers who pretend to handle American goods but in reality hold agencies for manufacturers in the states while making attempts to sell only the products of other countries. It is well known that vast opportunities exist in these countries and increasing strength of financial institutions in the West speaks well for future engineering enterprises of this nature.

Especially is the growth of the acceptance plan among banking institutions of the West to be noted with extreme satisfaction.

As an instance of growth of this nature the banking institutions of San Francisco may well be cited. A year ago the clearings of these banks reached what was then thought to be a wonderful showing in that the ten million dollar mark was passed as compared with the previous exposition year in which seven and three quarter millions had been reached. Today however, the daily clearings exceed thirteen and one-half millions of dollars. Repeatedly, the lead of San Francisco banks among the great financial institutions of the United States has been pointed out in the financial papers of the country. In the nation's honor roll of banks dealing in acceptances another illustration is afforded of the progressive spirit animating the big money changing houses of this city. In a compilation of the ninety banks and trust companies doing the largest acceptance business as of June 20, just completed, San Francisco is represented by five banks, the Anglo and London Paris in twelfth place with outstanding acceptances of $7,461,141, the Crocker National in twenty-sixth with $2,175,829, Bank of California in twenty-seventh with $2,055,489, Wells, Fargo Nevada in sixtieth with $347,777 and First National in seventieth with acceptances of $231,268. Rated according to percentage of outstanding acceptances to capital and surplus, the Anglo and London Paris is placed first among all the banks in the United States dealing in acceptances, while the Crocker ranks twentieth, California fifty-ninth, First National seventy-sixth and Wells Fargo eightieth.

Such banking institutions as these which are daily growing in strength throughout the West mean much for the future commercial and engineering activity of the great Pacific Area.

The Value in the Junk Heap

In the Journal of Electricity for May 1, 1917, on page 363, comment was made on the fact that five million empty five-gallon oil cans had been recently shipped to the Orient from Seattle as junk and the suggestion was there made that American enterprise should awaken to the value of the junk heap generally and put to profitable advantage the enormous waste contained in the annual junk heap in America that proves of practically no profitable return.

It is interesting to recite some of the uses to which junk tin of the nature above mentioned is put by the Oriental tradesmen according to information collected by the department of commerce.

The tin shops purchase them for making all kinds of household utensils—lamps, cookstoves, pots, pans, sprinklers, small pumps (for pumping oil out of full tins), and innumerable other articles. The kerosene tin is used as a biscuit display box by removing one face and substituting glass; a new top is affixed and it becomes a rice container; it is cut diagonally into two parts to make two dustpans. Without alteration tins are used as camphor-oil, lime, alcohol, and molasses containers.

While America is known throughout the world as a nation of intense activity and inventive genius, still the gigantic waste observable on all sides is a source of shock to the foreign observer.

It is well in these days of industrial tensity due to the straining of every nerve for increased production that the prodigious wastes in paper, boxing, tin, wrapping clothes and discarded machinery be carefully gone over with the eye for waste prevention and good is bound to result.

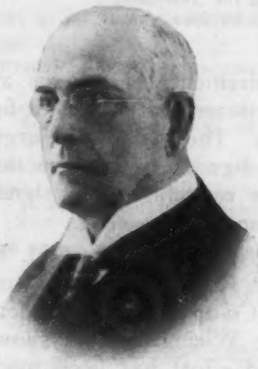
One great railway in the West is said to have realized recently over a half million dollars from the sale of junk iron. Perhaps the waste copper and other valuables in discarded electric appliances might well pay the contractor and dealer for ferreting out among their customer list.

Let every reader who peruses this line endeavor to save some of the former waste of which he is familiar either at home or in the office—and then think of the gigantic total that could be accomplished by the combined effort of a hundred million people in the saving of the annual national junk heap, hitherto abandoned.

THE NEW JOURNAL SERVICE: Acting upon the principle that "we profit as we serve" the Journal of Electricity will inaugurate a new and unique institution in technical journalism with its October first issue. During the past months we have been receiving increasing calls for men to fill high salaried positions. So much so that it has been impossible to secure sufficient information on applicants to meet the particular demands of each case. In view of this fact a service department will be opened at an early date to meet this long felt want. Central station managers and others having positions open are ugred to make known their wants to the editorial department of the Journal. This information will in all cases be considered confidential. The names of such of our paid subscribers, who so desire, will then be given to those having the positions to fill and the files containing information in behalf of the applicants placed at their disposal. This service is to be founded solely with the purpose in view of building up the usefulness of the Journal of Electricity which is now rapidly winning its way into every phase of the electrical industry in the West. From those applicants who are successful only a nominal fee will be asked, such in fact as will bear only the actual expenses involved in carrying on the work. The service of this department will, however, be available to only those who are paid subscribers of the Journal of Electricity.

PERSONALS

M. C. Osborn, commercial agent of the Washington Water Power Company, and president of the Northwest Electric Light & Power Association, is making good in every detail of the work that is before him in directing the task of preparation for the largest and most enthusiastic convention ever held by his association, which is to take place in Spokane, Sept. 12-15, 1917. As an instance of his foresight and thoughtfulness a quotation from a recent letter to the Journal of Electricity is as follows: "Concerning the special car from California, as soon as you know the number of people coming I would like to be advised whether or not you wish to have me make hotel reservations or whether you intend to have your lodgings in the car. We wish to make special efforts for the comfort and entertainment of the California delegates. It is rather too early to predict but it looks now as though we were going to have the largest attendance in the history of the association." All well wishers of the West are back of Mr. Osborn in his efforts to put over this task and as a consequence a splendid and enthusiastic gathering is bound to result.



W. H. P. Hill, formerly with the Northwestern Electric Company, is now sales manager of the Idaho Power Company.

E. Okawara, director of the Tokyo Gas Company, of Tokyo, Japan, is making a tour of inspection of gas industries in the United States.

A. K. Baylor, of the General Electric Company's staff in New York City, is expected on the Pacific Coast during the latter part of September.

C. B. Wirt has been transferred from the Seattle office to the Portland office of the Westinghouse Electric Manufacturing Company, in the sales department.

C. D. Monteith, now with the Missoula Light & Water Company of Missoula, Mont., but formerly with the Northwestern Electric Company of Portland, is a recent Portland visitor.

J. T. Whittlesey, general manager of the Universal Electric and Gas Company of San Francisco, is now comfortably settled with his company force in the new headquarters at 469 Sutter Street.

J. J. Wood, chief engineer of the Fort Wayne Electric Works of the General Electric Company, is a recent San Francisco visitor and has left for a visit to the Yosemite Valley. Mr. Wood is the inventor of the historic Wood-arc machine.

L. A. Knott, manager of the San Francisico office of the Sangamo Electric Company, is back again in San Francisco after an interesting and profitable trip through the principal cities of Southern California.

J. S. Shell, formerly in the commercial department of the Portland Railway, Light and Power Company, is now a captain in the U. S. Quartermaster's Department, stationed at Fort Sam Houston, Texas.

Girard B. Rosenblatt, engineer in charge, mining division, Westinghouse Electric and Manufacturing Company at Salt Lake City, Utah, has been transferred to the grade of member in the American Institute of Electrical Engineers.

J. C. Zancker, northwestern representative of the Federal Sign System (Electric) has returned to Portland from a trip to Vancouver, B. C., where he attended a recent gathering of power men composed of men interested in this industry living in Western Canada.

H. N. Keifer, formerly district engineer for the Northern Electric Co., Vancouver, B. C., has returned to Vancouver after having spent several months in New York and has opened an office in the Standard Bank Building, where he will carry on a consulting and general engineering business.

Clotilde Grunsky, daughter of C. E. Grunsky, the well-known consulting engineer, will join the editorial staff of the Journal of Electricity on October 1, in the capacity of associate editor, and in charge of social service and welfare work. Further interesting announcements regarding her future activities with the Journal of Electricity will be found on the editorial page.

C. O. Poole, chief engineer Nevada-California Power Company and Southern Sierra Power Company of Riverside, California; **J. G. Scrugham,** state engineer for Nevada; **L. M. Klauber,** superintendent of the electrical department for the San Diego Consolidated Gas & Electric Company, and **H. A. Barre** and **R. E. Cunningham,** superintendent of electrical distribution for the Southern California Edison Company of Los Angeles, were at San Francisco during the past week attending a meeting of the engineering committee of the Pacific Coast Section N. E. L. A., called by Chairman **J. E. Woodbridge.** Local men in attendance included **S. J. Lisberger** and **J. P. Jollyman** of the Pacific Gas & Electric Company, and **John A. Koontz** of the Great Western Power Company.

Captain David T. Mason, formerly professor of forestry at the University of California now with the battalion of foresters of the engineer regiments of the United States Army, is in Washington, D. C., and expects to leave for France at an early date. Mr. Mason spent several years in Forest Service in the mountains of Montana with headquarters at Missoula before undertaking work in the faculty at the university. His long practical experience and high standing in educational circles make him an unusually valuable man in the work he expects to undertake in France at an early date.

OBITUARY

Ernest Haughton, manager of the Chicago Bryan-Marsh division of the National Lamp Works, was killed, with Mrs. Haughton, Wednesday night, Aug. 22, while driving by automobile from Association Island to Paul Smith's in the Adirondacks.

Mr. Haughton was a member of a number of engineering and civic organizations and took great pride in service to his fellow men. He was a prominent advocate of many of the extraordinary movements adopted by the National Lamp Works in behalf of employes and his interest in their welfare never abated. He was an honored and trusted executive of their savings association and a director of the trust fund created for the investment of these savings. Two children survive Mr. and Mrs. Haughton, Julia, aged 11, and Ernestine, aged 5. The funeral was held in Henderson, Ky., on Monday, August 25, and memorial services held at the East Cleveland, Ohio, Presbyterian Church.

MEETING NOTICES FOR ELECTRICAL MEN

(As this issue of the Journal of Electricity goes to press the most favorable prospective reports from the coming conventions are heard on all sides. The Northwest Electric Light & Power Association at Spokane, the Pacific Coast Gas Association at Santa Cruz, and the various associations of contractors and dealers in Washington, Oregon and British Columbia all have before them splendid convention programs, covering topics of timely interest to men of the industry throughout the West. Considering the serious character of the times these gatherings will all be unusually well attended. In the following lines will be found briefs concerning these and other meetings of electrical men in various sections of the West during the current month.—The Editor.)

SYNOPSIS OF N. W. ASSOCIATION CONVENTION PROGRAM

Hotel Davenport, the Convention Headquarters

PRESIDENT M. C. Osborn will call the convention to order at 10:30 a. m., Wednesday, Sept. 12th, in the Hall of the Doges, Hotel Davenport, Spokane. After an address of welcome by the Mayor and response by D. H. Huntington, president of the Washington Water Power Co., various committee reports and the president's address will be presented. The morning session will conclude with a paper entitled "Aphorisms," by J. C. Ralston, who epigramatically treats of the application of observation, imagination and technique to the utility business.

Wednesday afternoon will be occupied with the reading and discussion of an exhaustive paper on "Practical Central Station Salesmanship," by L. A. McArthur, chairman-editor, assisted by Geo. Bowen, S. H. Hoag, W. H. Lines, Lewis A. Lewis, and C. R. Young. This paper clearly defines the field and policy of a power company in the sale of appliances. Emphasis is placed on advertising, appliance value as cost, plans for selling ranges and approved methods of operating an electric store.

The Luxuriant Reception Room

"How the Engineer Can Assist the Commercial Department" will be the subject of the session on Thursday morning. This paper, by D. F. Henderson, chairman-editor, and G. L. Duffy, H. C. Henkle, A. S. Hall and L. T. Merwin, is filled with valuable data on the distribution system requirements of various appliances, including ranges and water heaters. Cost figures are a prominent feature. The gist of the argument is that the engineer's figures of construction costs and his co-operation in reducing them should be the basis of all new business efforts.

On Thursday afternoon A. C. McMicken, H. H. Schoolfield, L. R. Grant, F. O. Broili and Foster Russell will present a paper on "Co-operation in Modern Home and Apartment House Wiring." This shows that in the past no concerted effort has been made to increase the number of baseboard outlets in new houses and apartments. Suggestions are given whereby central stations may secure the co-operation of architects and contractors to this end. On Thursday evening F. D. Fagen, Pacific Coast manager of the Edison Lamp Works, will give an illustrated lecture on "Commercial and Residential Illumination."

"The report of the Electric Range Committee," W. R. Putnam, chairman-editor, will occupy Friday's sessions, both morning and afternoon. This includes the report of several subcommittees—"Merchandising," as printed in full in this issue; "Possible Improvements," in burners, ovens and general design of ranges; "Routine," handling of orders, billing, maintenance and follow-up work; "Commercial Baking and Cooking," including rates, present status in the West, difficulties experienced in introduction, average revenue, diversity factor, selling policy and general situation throughout the world; "Training Salesmen and Demonstrators," including qualifications and compensation; "Advertising" and "Electric Water Heating," the last named appearing in extended abstract in these columns. Papers will also be presented on "Comparative Tests of Cooking Fuels," by B. L. Steele, and "Bus-Bar Density of Ranges," by H. B. Peirce, these papers also being published in this issue.

The Assembly Hall

The banquet on Friday evening will be informal. On Saturday an instructive and interesting visit will

be made to the Bunker Hill and Sullivan mine, mill and smelter at Kellogg, Idaho.

Washington Association of Electrical Contractors and Dealers

The convention of the Washington Association of Electrical Contractors and Dealers is to be held at Spokane, September 13-15, 1917. A most helpful program has been prepared for this gathering, which in detail is as follows:

Thursday

10:00 a. m. Address of Welcome.....Mayor Fleming

Response .....V. S. McKenny
President Washington Association of Electrical Contractors and Dealers.

Paper—"The Association Firing Line".....H. C. Rohrback
State Representative of the Pacific Coast Conference Board.

12:00 m. Luncheon (Davenport's) Five Minute Talks.

2:00 p. m. Joint Meeting with Northwest Electric Light and Power Association. Subject, "Co-operation in Modern Home and Apartment House Wiring Practice."

6:00 p. m. Dinner (Davenport's) for Contractors and Jobbers. Address by .....Harry Byrne

7:30 p. m. Business Session. Election.

Friday

Meeting of Committees. Entertainment of Guests.

12:30 p. m. Luncheon (Davenport's).

2:00 p. m. Paper—"The Relation of the Electrical Contractor to the Central Station".....Mr. O. B. Coldwell
General Superintendent Portland Railway, Light and Power Company.

Paper—"Co-operation Between the Electrical Contractor and Jobbers" .....W. S. Berry
Sales Manager Western Electric Co.

Paper—"The Electrical Contractor".....Hugh L. Tinling

Paper—"The Inspector's Viewpoint".....W. A. Davis
Chief Electrical Inspector, City of Spokane.

7:00 p. m. Banquet (Davenport's). This will be a joint banquet with convention members and friends of the Northwest electric Light & Power Association.

The architects of Spokane will be guests at this banquet.

Albert H. Elliot of San Francisco will address the meeting at the invitation of the Washington Association of Electrical Contractors and Dealers.

On Saturday, September 15th, a trip is planned to Kellogg for inspection of mill and smelter of the Bunker Hill and Sullivan, the greatest lead and silver producers in the world.

Train will leave O.-W. R. & N. depot at 6:55 a. m., arrive Kellogg 10:45 a. m.; leave Kellogg at 2:45 p. m., arrive Spokane 7 p. m.

From all appearances the convention will be well attended and a new enthusiasm among contractors and dealers in the northwest is bound to result.

San Francisco Electrical Development & Jovian League

The largest and most enthusiastic meeting ever held by the San Francisco Electrical Development & Jovian League took place Wednesday, September 5, 1917, at the Palace Hotel. The occasion was the initiatory meeting of the fall series. In the absence of President R. M. Alvord of the General Electric Company, who is making an extended business visit in the East, R. F. Behan of the Westinghouse Electric & Manufacturing Company took charge of the meeting and introduced Tracy E. Bibbins of the Pacific States Electric Company as chairman of the day.

W. M. Deming, who has recently assumed the business management of the Journal of Electricity was the speaker of the day and chose as his subject "Meeting Today's Business Situation." In a most interesting and helpful manner Mr. Deming drew upon his knowledge acquired in twenty-nine years of service with the General Electric Company to illustrate his points which he so forcefully brought out regarding the present critical situation in the world's industrial activity.

BUILDERS OF THE WEST—XII

JOHN M. ESHLEMAN

MAX THELEN

That the great hydroelectric securities of the West are today assisting in financing the world markets for international bond issues is in a large measure due to the fact that an harmonious, workable relationship has been established between the three parties to the issues involved in efficient utility supervision and regulation—namely between the public, the utility and the regulatory body. To the late John M. Eshleman, former president of the California Railroad Commission, and to Max Thelen, his worthy successor, the West must ever be indebted for the establishment of a tradition in fair and painstaking investigation and decision in matters pertaining to public utility activity throughout the nation, that once again adds to the building of an empire a unique and unusually helpful factor in civic growth. Through the courtesy of the H. S. Crocker Company of San Francisco, the excellent likeness of the late president of the California Railroad Commission is herewith reproduced.

It was announced that the Jovian Red Cross Smoker would take place on the evening of September 26 and all are promised an unusually interesting program combined with a jolly good time.

Los Angeles Jovian Electric League

The Los Angeles Jovian Electric League is awakening from its period of inactivity during the summer months and an interesting series of luncheons are in the stage of preparation for the fall months. Detail announcements will be made in the next issue of the Journal of Electricity.

San Francisco Section A. I. E. E.

The program committee of the San Francisco Section of the American Institute of Electrical Engineers, under the able leadership of F. C. Platt of the Pacific Gas & Electric Company, is planning a series of meetings for the San Francisco Section during the coming season at the San Francisco Engineers' Club Rooms that will prove unusually helpful and profitable. Detail announcement of these programs will be given at a later date. The first meeting of the fall season will be on the evening of September 28th and a most interesting subject will be under discussion, namely—the sub-

marine. All members are urged to start the season with a good attendance.

The San Francisco Engineers' Club

While no formal program meetings have been held during the past semi-monthly period, the lunch service at the club is proving of such a high degree of excellency that the San Francisco Engineers' Club is earning a unique distinction in club circles of that city. This fact alone is having a very marked effect in the attendance at the noon day luncheons. Once more the informal gatherings and rounds at dominoes are becoming prevalent and a spirit of comradery and good feeling is displayed on all sides.

The Pacific Coast Gas Association

Extraordinary preparations are in progress for the twenty-fifth annual convention of the Pacific Coast Gas Association, to be held this year at Santa Cruz during the third week in September.

The usual announcement has been sent out by the secretary of the Association, Mr. Henry Bostwick; that is to say, usual as to form in that it conveys the customary information concerning time and place, transportation, hotel accommodations, and so forth. But this year the announcement is unusual in that it offers more than the ordinary inducements to the Association's membership to gather in force at the forthcoming convention on the shores of Monterey Bay.

The intellectual program offered for consideration is remarkable in its comprehensiveness. There are more papers than ever before and more varied in their selection. The program follows:

President's Address ..... C. B. Babcock
Who's Who: The Public; Rate Fixing Bodies; Rates; or the Company? ..... J. M. Berkley
Hotel and Restaurant Fuel Sales ..... W. E. Dugdell
Scientific Effect of the Use of Natural Gas and the Use of Mixed Gas on Consuming Devices ..... Frank S. Honberger
Early History of the Development of Oil Gas ..... L. P. Lowe
Radiant Heat ..... Fred Champion
Advertising Gas Through Appliances ..... A. L. Crane
Systematic Salesmanship ..... Geo. P. Egleston
Eliminating Waste ..... A. B. Day
Can Profit Sharing with Employees be Successfully Worked Out? On What Lines and Where? ..... R. H. Ballard
Natural Gas ..... A. B. Macbeth
Gas Heating Systems ..... M. L. Neely
Gas Measurement ..... B. G. Williams
Standard Flanges for Flanged Pipes, Valves and Fittings, ... J. P. Baloun
Some Notes on the Industrial Use of Gas in England ..... Robert W. A. Brewer
A Study of Efficiency and Utilization Gas in Top Burners .. .. Prof Charles Norman Cross
Wrinkles ..... D. J. Young
Experiences ..... John Clements

In addition, it is promised that the reports to be rendered by the chairmen of our several standing committees will be of more than passing interest.

There is to be a gas exhibit upon a scale never attempted before. This is being arranged under the direction of Mr. B. S. Pedersen. An admirable location has been secured in the Casino convenient to the travel between the hotel and the beach. The Gas Appliance Committee announces that the following thirty-two exhibitors have secured space in the Gas Exhibit at the forthcoming convention:

Popular Lecture on Home Lighting

The second of the series of illustrated popular lectures is now ready for distribution. This lecture answers the question "how shall I light my home?"

This lecture with accompanying lantern slides, may be secured for presentation upon application to the General Offices of the Illuminating Engineering Society, 29 West 39th Street, New York, N. Y.

President Vail Visits Pacific Coast

One of the most interesting happenings in electrical circles of the past several months is the recent visit to the Pacific Coast of Newcomb Carlton, president of the Western Union Telegraph Company and Theodore N. Vail, president of the American Telephone and Telegraph Company. Announcement of the presence of these distinguished visitors was made in the columns of the Journal of Electricity Aug. 15, 1917, page 185.

In view of the present war situation, a most interesting feature of his visit was a side trip to the Monterey Presidio, 125 miles south of San Francisco, where the Eighth battalion of the Signal Reserve Corps is in intensive training. As is well known, this battalion is entirely composed of employes of the Pacific Telephone and Telegraph Company, who have been at Monterey since July 1, engaged in active preparation for the work to come. Mr. Vail was accompanied to Monterey by H. T. Scott, chairman of the board of directors; G. E. McFarland, president, and J. C Nowell, general manager

G. E. McFarland, president of the Pacific Telephone & Telegraph Co., and Theodore N. Vail, president of the American Telephone & Telegraph Co.

of the company, the party being in direct charge of Major D. P. Fullerton of the Eight battalion. The visiting guests were spectators at a review given in their honor, and were much pleased at the appearance and condition of the Telephone contingent. Mr. Vail evinced much interest in the conversations he held with many of the officers and "rookies." He addressed the men in part as follows:

"It is with pleasure and satisfaction that I meet you on the shores of the Pacific. Only a few days ago it was my pleasure to meet on the shores of the Atlantic a group of reserves, all from the Bell System, who may be now on their way to the field of activity.

"While there is sorrow and pain connected with the going yet it is not so much because of the going as it is because of the existence of the necessity for your going.

"The necessity existing—and it does—there should be joy and satisfaction that you are going to protect your country, which protects you in your enjoyment of life and liberty, the country which protects your substance and gives you opportunity such as no other country gives its people."

NEW POWER BUSINESS AND FINANCIAL ITEMS

Commission Frowns on Reduced Rate

The Home Telephone Company of Portland, which recently passed into the hands of a receiver, sought to increase its subscribers by offering three months' free service. When this procedure was brought to the attention of the Oregon Public Service Commission it immediately issued an order enjoining the company from establishing such a practice. The commission held that "giving free service for three months or any other length of time, or at a reduced rate, to new subscribers is the giving of an undue and unreasonable preference and advantage to new subscribers over old ones. * * * Any utility which furnishes or offers to furnish service free, or at reduced rates, or which makes any concession whatsoever to new subscribers not only violates both the letter and the spirit of the Utilities Act, but subjects those to whom such service is furnished to a severe penalty."

Increased Earnings at Portland

Increase of 29 per cent in net earnings of the Pacific Power & Light Company, under the same management and control as the Portland Gas & Coke Company for June compared with the same month of last year is attributed to the fact that a year ago operating expenses were not normal, according to official reports just issued. For the same reason that adverse conditions influenced the operation of the properties, operating expenses for the fiscal year just closed advanced 8 per cent, while gross earnings increased only 7 per cent, making a gain of 6 per cent in net earnings over the preceding period.

Following is a summary of the statement:

	June, 1917	12 Months
Gross revenue	$132,346	$1,537,523
Operating expenses	57,825	771,547
Net earnings	$ 74,521	$ 765,976
Balance after deducting all fixed charges.	$ 38,182	$ 350,897

Utilities Commission of Idaho

In the matter of the application of Nevada Power Company for a certificate of public convenience and necessity, it appearing that although the territory through which the Nevada Power Company proposes to construct such transmission and distributing lines is contiguous to territory now occupied and supplied by the general electrical system of the Idaho Power Company, said Idaho Power Company has filed its appearance in this matter and has consented to the construction, maintenance and operation of such transmission and distributing lines by said Nevada Power Company for the restricted purposes as hereinbefore set forth and for the sale of the electric current and energy, so transmitted, consequently the commission issued the request.

In the matter of the application of Utah Power & Light Company for a certificate of public convenience and necessity in the village of Newdale, Fremont County, Idaho, the commission has ordered that the Utah Power & Light Company be and it hereby is authorized to continue the furnishing of electrical service to the village of Newdale, Idaho, and its inhabitants.

A New Business Record for Colorado Power Company

The Colorado Power Company reports July as the best month in the corporation's history as to new business. In July it closed seventeen new power contracts aggregating 3259 h.p. with an estimated annual revenue of about $112,000. Business disconnected in the same month aggregated 555 h.p. with an annual revenue of about $23,000. The resultant net gain was 2695 h.p. and $89,000 per annum, respectively.

For seven months ended July 31st, net gain in power contracts amounted to 5058 h.p. with an estimated annual revenue of $150,000.

Estimated annual gross revenue from business under contract awaiting connection as of July 31st, was $154,800. It is expected that all of this business will be operative by the end of the present year.

This company generates over ninety per cent of its energy hydraulically. Under the terms of certain large wholesale contracts it can withdraw from the wholesale service as required by the retail service. No plant extensions are necessary to serve the business above mentioned and in fact the corporation can, without appreciable additional investment, serve approximately 15,000 h.p. additional retail load. The increased load from retail territory is occasioned by substantial mining operations on a large scale as well as by new electro-metallurgical reduction processes on established commercial lines.

Increased Load for the Western States at Richmond

The Swift Nail and Tack Company will locate a factory at Richmond, employing 60 men to start. This is the fifth concern to locate at Richmond during the past month three of which have already closed contracts with the Western States Gas & Electric Company for their power requirements. The company is negotiating for the power requirements, amounting to 100 h.p. in motors, of the Allied Union Brick Company which has taken over the old Cary brick plant and will start operations within the next month after extensive improvements. During the week ended August 10 the Western States Company secured contract for an additional 10 h.p. in motors for the Western States Porcelain Company.

Motor Equipment for Pulp Mill in Washington

Orders for the complete motor equipment of the new plant of the Washington Pulp & Paper Company's new mill at Port Angeles, Washington, have been received by the Westinghouse Electric & Manufacturing Company, of East Pittsburgh, Pa. There are included a total of 42 motors with a total of 3380 horsepower, two motor generator sets, and two 2000 kva. transformers, 6600 to 2300-460 volts, and three 300 k.v.a. transformers 2300 to 460 volts. All motors of 500 h.p. and above will be supplied at 2300 volts. Synchronous motors will be provided with starting panels; these as well as the starting switches for induction motors will be equipped with ammeters and overload and no-voltage protection.

Foreign Orders Taken in San Francisco

The Pacific Electric Mfg. Co. of San Francisco is filling many foreign as well as domestic orders for oil and air switches. In transit to the Pearson Oil Syndicate at San Paulo, Brazil, are 12 tons of oil switches; the Cerro de Pasco mines in Peru have 12 tons of oil and air switches enroute. A shipment of 3700 lbs. of air break switches has been sent to Bangkof, Siam. Two 45,000 volt oil switches have been sent by express to Anniston, Alabama, seven 35,000 volt pole top switches to the Chilecothe encampment in Ohio, as well as to the American Lake encampment. Both the Washington Water Power Co. of Spokane and the American Power and Light Co. of Dallas, Texas, have ordered two 60 k.v.a. switches and many other smaller orders are being filled.

New Factory Load in San Francisco

American Ever Ready Works of the National Carbon Co., expect to move into their new factory at San Francisco on September 15th. Complete details will be published later.

Los Angeles Firms Get Australian Business

The U. S. Electrical Manufacturing Company of Los Angeles, manufacturers of direct and alternating current machinery have received two large contracts from the Australian government for electric motors for use in Australian canneries. This is only one instance of the large orders received lately for cannery motors, the others being for the entire motor equipment for H. G. Prince Company of Fruitvale, and the United Canneries Company of Ontario. Business in Portland, Oregon, has also made tremendous leaps.

Fairbanks Morse Secures Big Sale

Fairbanks, Morse and Co. have recently equipped the Berkeley, Calif., plant of the Hall Scott Motor Company, manufacturers of aeroplane motors, with 69 electric motors aggregating 300 h.p. and ranging from 1 to 10 h.p. in size. They have also contracted with the National Ice and Cold Storage Co. to equip all of their California plants with electric motor drive superseding steam drive of compressors. The order includes three 50 h.p., four 75 h.p., two 100 h.p., two 150 h.p. and two 175 h.p. motors as well as 26 motors ranging from 5 to 25 h.p.

Westinghouse Motors for Nevada

An order for electric hoisting equipment from the Nevada Consolidated Copper Company for its mine at Ruth, Nevada, calls for a 400 h.p. Westinghouse type Cw wound-rotor induction motor and complete control equipment, comprising a Westinghouse liquid controller with necessary electromagnetic switches. The hoist is to raise a load of 12,000 lbs. of ore every 86 seconds through a distance of 720 ft.

Southern Pacific Makes Large Locomotive Purchases

Sixty-five new locomotives, costing over two and a half million dollars, are on order for the Pacific System lines of the Southern Pacific according to an announcement by Wm. Sproule, president of the company who returned recently from New York and other Eastern cities. Ten of the locomotives are to be built at the company's shops. This latest order brings the total expenditures for new equipment by the Southern Pacific and Pacific Fruit Express of which it is half owner, to twenty-four and a half million dollars.

Turbine Auxiliary in Alaska

The Alaska Treadwell is sending its 2000 kw. turbine across the channel from Douglas Isalnd to operate an auxiliary at the Alaska-Juneau mill.

Large Increase in Electric Energy Output at Stockton

The electric heating and cooking campaign conducted by the Stockton, California, division of the Western States Gas & Electric Company has resulted in the addition of more than 453 kw. to Stockton's energy output. More than 50 electric ranges have been sold, 41 water heaters and 18 air heaters. New business recently closed by the Company includes 150 horsepower additional for the Samson Sieve-Grip Tractor Company and 60 horsepower additional for the State Hospital. The Company is negotiating with the Union Ice Company for the electric energy requirements of its new refrigeration and cold storage plant, amounting to about 200 horsepower in motors. Stockton's new city directory fixes its population at 48,008, which is an increase of 3,288 over last year.

Kalispell Company Extends Service to Forty-two Ranches

Irrigation in the Flathead Valley of Montana by means of electric pumps is receiving more and more attention each year. During the present season, which has been unusually dry, a number of ranchers who operate pumps for irrigation have harvested enormous crops as a result of their foresightedness. These pumps ae operated electrically with current furnished by the Northern Idaho & Montana Power Company, which is now extending similar service to forty-two other ranches in a 4,000-acre tract just west of Kalispell. Besides irrigating, farmers will use electric power for grinding feed, sawing wood, separating milk, lighting barns, etc. A number of other agricultural districts have petitioned the company for electric service and investigations are being made.

Lend Electric Apparatus Experts to the Government

Through the agency of the national committee on gas and electric service of the Council of National Defense a number of electric light and power companies have arranged to loan men to the Quartermaster General's department to visit plants where electric apparatus is in process of manufacture, to supervise progress and expedite delivery. The services of these experts will be voluntary. Seven of the largest electric light companies have also furnished Colonel Littell a number of men to act as purchasing agents to assist the purchasing department of the Quartermaster General's Corps.

Urgent Needs of the Ordnance Department of the Army

The United States Civil Service Commission announces the following open competitive examinations for positions in the several ordnance establishments of the War Department or in or under the office of the Chief of Ordnance, War Department, Washington, D. C. The salaries named are for entrance:

Mechanical engineer, artillery ammunition, $3,000 to $3,600 year.

Mechanical engineer experimental work, $2,500 to $3,000 year.

Mechanical draftsman, $1,000 to $5,400 year.

Apprentice draftsman, $480 year.

Inspector of artillery ammunition, $1,500 to $2,40 year.

Inspector of field artillery ammunition steel, $1,500 to $2,400 year.

Assistant inspector of field artillery ammunition steel, $3.50 to $5 day.

Inspector of ammunition packing boxes, $3.52 day to $1,800 year.

Inspector and assistant inspector of powder and explosives, $1,400 to $2,400 year.

Inspector of ordnance equipment, $1,500 to $2,400 year.

Assistant inspector of cloth equipment, $80 to $125 month.

Assistant inspector of leather, $100 to $125 month.

Assistant inspector of small hardware, $80 to $125 month.

Assistant inspector of textiles, $80 to $125 month.

Assistant inspector of leather equipment, $100 to $125 month.

Clerk qualified in business administration, $1,200 to $1,500 year.

Index and catalogue clerk, $1,000 to $1,200 year.

The examination for index and catalogue clerk is open to both men and women; the other examinations are open only to men.

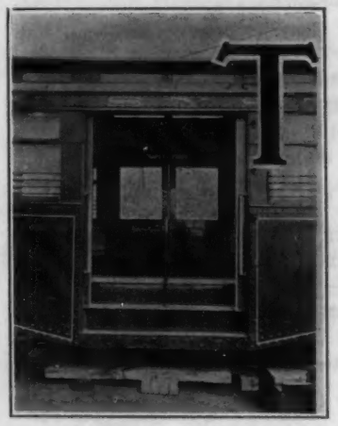
The Government urgently needs men for the work above indicated, and qualified persons are urged as a patriotic duty, to apply for examination. Until further notice applications for the positions named will be received at any time by the United States Civil Service Commission, Washington, D. C. Papers will be rated promptly. Applicants will not be required to appear at any place for examination, but will be rated principally upon the elements of education, training, and experience, as shown by their applications and by corroborative evidence.

Full information concerning examinations, application blanks, etc., may be obtained by calling in person upon the secretary of the local board of civil service examiners at the post office in any city in which city delivery of mail has been established, or by communicating with the United States Civil Service Commission, Washington, D. C.

LATEST IN EVERYTHING ELECTRICAL

(New features in car design are constantly appearing in the interurban electric systems of the West that vastly forward not only the comfort and safety of the passengers but the efficiency of the handling of the traffic of an entire system. Here is an article on the new center entrance cars that have recently been placed in operation on the Key Route Systems of California. This system, together with the Southern Pacific lines in the San Francisco Bay region, is said to cause more people to pass daily through the great Ferry Building at the foot of Market street in San Francisco, than in any other depot of the world, with the possible exception of the union depot in Paris. Other items of interest in new developments in electrical design follow this article.—The Editor.)

NEW CENTER ENTRANCE CARS FOR SAN FRANCISCO-OAKLAND TERMINAL RAILWAYS



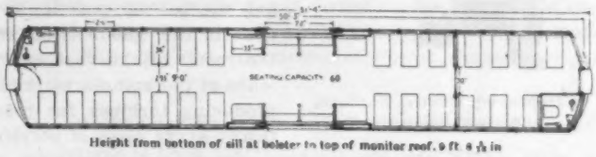
"Watch Your Step"

TWELVE cars of the type illustrated were lately placed in service on the Key Division of the San Francisco-Oakland Terminal Railways, the unique route which, combined with a ferry operated by the same company, connects Oakland, Berkeley and other suburbs of Oakland with San Francisco. A section of the lines is built out into San Francisco Bay for several miles upon a 200 ft. wide fill with masonry walls, and for one-half mile on a trestle which terminates in a large ferry house, and this section is operated at high speed. On the mainland, city streets are traversed to the terminals, reducing the speed and calling for frequent stops.

Hitherto the cars employed on the Key Division have been of the end-platform type; these new cars are the first to have center platforms. The reduction of time which the new type effects over the old, together with re-routing the lines and instituting a new express schedule, is expected to cut down the running time between the Oakland and Berkeley terminals by about 15 minutes.

The underframes have as their chief longitudinal members 6 by 3½ by ⅜ in. angle side sills and 8 in. I-beams. Channel crossings alternating 6 in. and 3 in. in size are connected to the center sills with corner brackets. Built-up bolsters of open-truss construction, bent down at the ends and lipped under the side sills, have 9 by 1 in. top-plate and 9 by 1¼ in. bottom plate. The arrangement of the diagonals will be seen in the framing diagram.

In the side construction a plate girder is formed of ⅛ in. plate riveted to the angle sill, to an angle at the top and to T-posts and channel door posts. Compensation for interrupting the plate girder construction at the side doors is obtained by framing the doors with 9 in. channels and with angles riveted into channel construction in the section of the top panel which spans the doors. The T-posts are 1¾ by ¾ by ¼ in., and extend to the top of the letter panel which is composed of No. 16 gauge steel, 8¾ in. wide, and riveted at the top to a light angle. Steel carlines reinforce the wooden carlines of the monitor deck. The two carlines nearest each end of the car are of suitable dimensions to properly support the pantograph trolley standard on the lines.

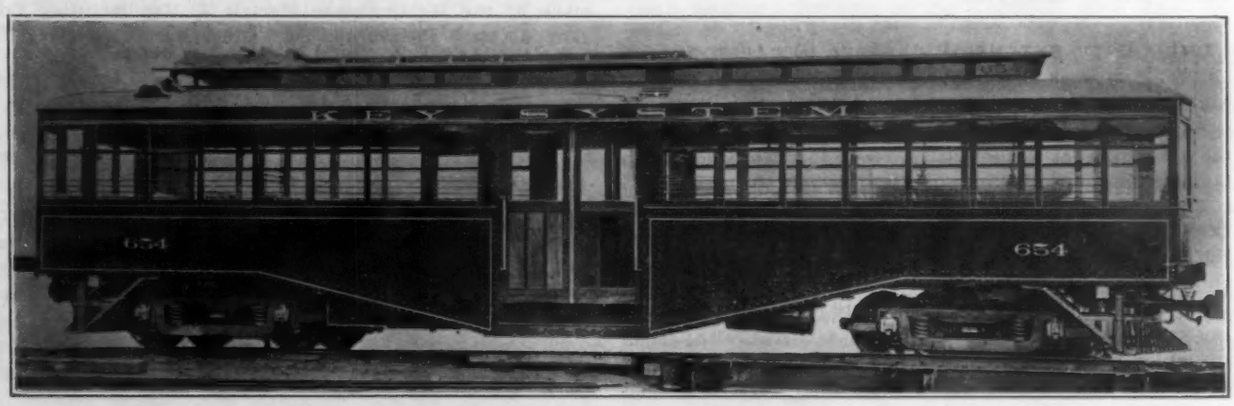


General Plan of Car Design

As the illustrations and floor plan clearly show the division of the car into smoking and general compartments, the seating arrangement, the cabs at the diagonal corners, and the door and step arrangements, these will not be described in detail. The Brill Renitent Posts are an important feature of the construction. As they are of spring-brass and form the runways for the lower sashes the sashes may be removed or inserted without tools and by simply grasping at the top and bottom and pressing sideways; they also make the sashes interchangeable. Renitent posts were furnished in the 30 city cars built for this company. The upper sashes are stationary and are framed continuously from door pots to corner post, the top rail being capped by flanging the lower edge of the letter panel.

The partitions, doors, window sashes, ventilator sashes and other wooden parts of the interior finish are of mahogany, and the ceilings and wainscoting are of 3/16 in. composite material. Brill "Winner" seats with 18 in. backs and corner grab-handles are the same as are used in the city cars.

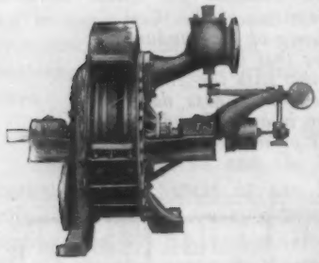
The trucks on which the cars are mounted are of the Brill 27-M C. B. 2 type with 6 ft. 6 in. wheel base and provided with 34 in. diameter wheels.



Exterior View of New Cars for the Key System

CURTIS STEAM TURBINE FOR FANS, BLOWERS AND PUMPS.

The General Electric Company of Schenectady, N. Y., has developed a Curtis steam turbine in a wide variety of capacities to drive fans, blowers and pumps for boiler feeding and circulating systems.



Improved Curtis Turbine, showing Split Casing

It is called the Type L and is of the impulse type. The number of stages and rows of buckets vary with the capacity. The principles used and mechanical practice evident in the construction are the result of the vast experience of the manufacturers in producing turbines for practically every class of service. A split wheel casing is used to permit ready inspection of the buckets which are of bronze securely dovetailed into the rim of the wheel. The exhaust steam is free from oil and is well suited for heating feed water.

Speed regulation is close and reliable and the speed may be changed by hand wheel adjustment while the turbine is in operation. A constant running speed is maintained by a single and powerful speed governor mounted diirectly on the shaft and controlling a double balance piston valve type throttle.

A NEW HEAT INSULATING MATERIAL

Sil-o-cel is a white powder weighing about 8 lb. per cubic foot. It is found in a natural rock form in exceptionally pure deposit on the Pacific Coast. By a special process the powder form is produced. Sil-o-cel has an insulating value equal to cork, and ten or twelve times that of fire brick. Being almost pure silica its melting point is about 1610 deg. C. (2930 deg. F.) which is a great advantage over cork and most other insulating materials. Sil-o-cel is inert—it does not contain organic matter—it will, therefore, keep in good condition for all time. It is fire proof and germ proof, and lower in cost than most other insulating materials. Tests show that by surrounding a 30-gallon household boiler with a frame of ordinary tongue-and-groove wood, allowing a 3-inch space between the outer shell of the boiler and the inner shell of the tongue-and-groove holder filled with Sil-o-cel powder completely covering the boiler excepting the bottom, it will take several times as much heat energy to keep the water in the boiler hot with an ordinary galvanized uninsulated boiler as with the same boiler insulated with a covering of three inches of Sil-o-cel powder, as above described. It has been found that the total cost of insulating an ordinary household boiler with Sil-o-cel powder three inches in thickness including the cost of Sil-o-cel, lumber, labor and all incidentals, will be about $6.00.

UNIVERSITY EXTENSION CLASSES IN CALIFORNIA.

The first week of September saw the enrollment of thousands of students for the hundred and fifty University Extension classes, organized in San Francisco and Oakland by the University of California. The prospective students in these evening and Saturday classes are now being enrolled at the San Francisco headquarters of the University Extension Division in the Lick Building, 62 Post Street, and also at the University Extension headquarters in California Hall at the university.

The technical courses are unusually popular. The repair and maintenance of automobiles such a course, also, exclusively for women; automobile electricity, chemistry, chemistry for nurses, electricity, electrical shop work, household electricity, navigation and nautical astronomy, machine shop practice, telephony, wireless telegraphy, radio communication, a course for women in wireless telegraphy, woodwork, a course for women in woodwork, applied mechanics, and reinforced concrete.

SAFETY FIRST ENCLOSED LEVER SWITCHES

Safety-first Combined Lever Switches and Fuses as described in Bulletin No. 47380-A, which has just been issued by the General Electric Company, are destined to fulfill an important part in the present active campaign to safeguard life and property which is being carried on by such bodies as the Bureau of Standards, the National Board of Fire Underwriters, and by public service and safety commissions in several states.

The important features of the Safety-First Enclosed Lever Switches, as contained in the bulletin are:

1. Current-carrying parts are completely enclosed and inaccessible while alive.

2. Fuses are accessible only when they are "dead" and when the switch is in the "off" position

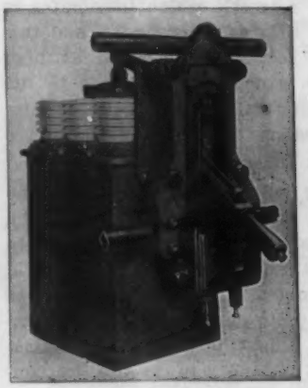
3. Switches can be locked in the "off" position.

4. The fuse chamber can be locked to prevent access by unauthorized persons, without interfering with the operation of the switch.

Full information regarding construction and dimensions of the three types will be found in this Bulletin.

MOTOR DRIVEN BULL FRAME

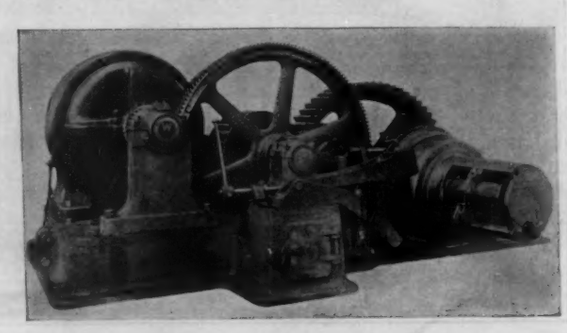
For drawing wire of sizes from 7/16 in. to 1 in. diameter, the two-block horizontal spindle bull frame shown in the accompanying illustration is made by the Morgan Construction Company of Worcester, Mass. It will handle square, hexagonal, and round sections with pull at the die of from 10,000 lbs. to 20,000 lbs.



New Wall Bracket for Circuit Breaker

A special feature of this line of machines is a winding block so arranged that while the pull is always close to the main bearing, the coiled wire moves out to the end of the block in a regular helix without bunching or crowding. In addition to the safety afforded by quickly stopping characteristic of individual drive, a friction clutch is contained in each block which instantly disengages the block from the mechanism. Thus by the movement of the clutch lever, the drawing may be stopped at any time regardless of the strain on the block.

This machine, which is intended for heavy work at high speeds, is equipped with a 150 h.p. type C. S. induction motor made by the Westinghouse Electric & Manufacturing Company at East Pittsburgh, Pa. Other sizes are driven by motors down to 50 h.p.



Improved Motor for Bull Frame

NEW BOOKS AND BULLETINS FOR ENGINEERS

New Apparatus

Century single-phase self-starting motors of 1/10 to 40 h.p. of the repulsion start induction type are described in bulletin 24 just isued by the Century Electric Company of St. Louis. The booklet contains 63 pages and is handsomely illustrated.

Electric Heating Appliances

One of the handsomest pieces of publicity that has made its appearance for some time is that of the Hughes Electric Heating Company of Chicago describing in a fifty-two page booklet the Hughes electric heating devices. Illustrations are given which show effectively the many uses of the electric range in domestic and commercial life.

The Hotpoint Electric Heating Company of Ontario, California are distributing to the trade a new list of prices on Hotpoint electrical appliances and an attractive pamphlet on "Why people buy the Hotpoint Vacuum Cleaner."

Scientific and Engineering

Carbon monoxide poisoning in the steel industry is the subject matter of technical paper 156 recently issued by the Bureau of Mines.

The monthly statement of coal mine fatalities in the United States, for May, 1917, by the Bureau of Mines, contains a list of permissible explosives, lamps and motors tested prior to June 30, 1917.

A booklet entitled "American Sea Power" containing a reprint of editorials dealing with the production of ships to meet the present emergency, has recently been issued by the Evening Mail of New York City. The booklet also contains a series of articles on oil and its relation to commercial and marine development.

Advanced first-aid instructions for miners, comprising a report of standardization by a committee of engineers, S. H. Halberstadt, A. F. Knoefel, W. A. Lynott, W. S. Rountree and M. J. Shields has made its appearance to the trade and will be found exceedingly useful and helpful. This little booklet of 150 pages is published by the U. S. Bureau of Mines.

A list of inspected mechanical appliances containing a list of inspected electrical appliances and a list of appliances inspected for the accident hazard, has been recently published by the underwriters' laboratories of the National Board of Fire Underwriters. The booklet is for service, not profit, and as a consequence it has unusual value for electrical engineers.

An address by W. H. Hodge, publicity manager of H. M. Byllesby & Company, "The Customer as a financial partner in a public utility," has been printed in pamphlet form under the title "Rational Public Ownership." It was made as a lecture April 2 in the Course in Public Utilities Operation of the Graduate School of Business Administration, Harvard University. Copies will be sent to inquirers upon request. Address the Publicity Department of H. M. Byllesby & Company, Chicago.

The possible recovery and utilization of pyrite occurring with bituminous coal is suggested in circular 5 of the Engineering Experiment Station of the University of Illinois by Professor E. A. Holbrook of the department of mining engineering. A series of experiments conducted on a commercial scale has shown that, where pyrite occurs in sufficient quantities to justify its recovery, a 50-ton plant may be designed to serve a single mine or group of mines which will yield a profit of about $75 per day, or $1.50 per ton of raw pyrite, with an initial capital cost of about $18,000.

The sixth annual report of the commissioners for the Toronto Hydroelectric System is now available. The report contains thirty-two pages of beautifully illustrated reading matter wherein is set forth the distribution of electric power in the City of Toronto and the issue of $2,750,000 of City of Toronto 4 per cent sinking fund debentures payable on 1st July, 1948, to provide the funds necessary for the cost of the said works, etc. The electric power required is supplied from Niagara Falls by the Hydroelectric Power Commission of Ontario.

Mechanical Equipment of Buildings.—Vol. 2

A reference book for Engineers and Architects, by L. A. Harding, and A. C. Willard, and published by John Wiley & Sons, Inc., N. Y. For sale by Technical Book Shop, San Francisco. Size: 7 by 9¼ in., 766 pp.; illustrated, flexible binding. Price $5.00.

This book is a new departure in the literature on the mechanical equipment of buildings. It proposes to deal not only with power plants and refrigeration, to which this volume is devoted, but also with the heating and ventilation of buildings which is considered in Vol. 1 already published. In addition to these two columes a third volumne on elevators, lighting systems, sprinkler systems, vacuum cleaning, and plumbing is now in preparation.

The aim has been to produce a reference book for engineers, containing sufficient theoretical and commercial data for practical use in the designing room, and also show the student of this subject the relation between the theoretical principles involved and their practical application to actual problems.

The authors are Louis Allen Harding, B. S., M. E., chief engineer and member of firm of John Cowfer Co., Buffalo, N. Y., and Arthur Cutts Willard, assistant professor of Heating Ventilation, University of Illinois.

A preliminary discussion of physical units and the measurement of heat, is followed by data and tables on the characteristics and performance of water, steam and air. Design and construction of boilers and power plants are treated in detail.

The chapters on artificial refrigeration contain comparative data on the various methods in use, and the attendant advantages of each. These cover the field so completely and so simply that the book will prove an indispensable aid for engineers installing mechanical equipment of this nature.

How to Make High Pressure Transformers

By F. E. Austin, professor of Electrical Engineering at Dartmouth College, Hanover, N. H. Size 4½ by 7 in., 47 pp., cloth binding. For sale at the Technical Book Shop, San Francisco. Price 65c.

This book tells in simple language just how to make different types of transformers for high voltage use. Information is given on the method of procedure for designing and constructing transformers for any special purpose, formulae being given for calculation of the various losses, thus insuring a suitable design. Full instructions for building the cores, and winding the coils, make this a valuable book for any person interested in high tension work.

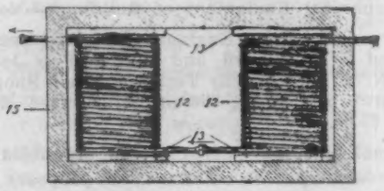
The author is head of the Department of Electrical Engineering in the Thayer School of Engineering, connected with Dartmouth College, and has published numerous other books on related subjects, which have been greatly in demand.

WHAT WESTERN INVENTORS ARE DOING

(High head water wheel development has proven in the past so eminently successful that design of this nature may now well be said to be traditional in its activity. Here is a brief description of a new patent relating to speed-governors by William A. Doble, formerly chief engineer of the Pelton Water Wheel Company. Other briefs on a cooling-coil, an electrical motive apparatus, an electrical massage apparatus and an electric-lamp support follow.—The Editor.)

1,235,181. **Cooling-Coil.** Augustine S. Beltink, Oakland, Cal.

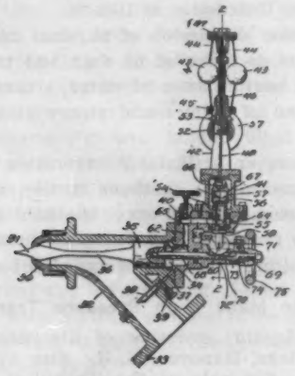
In a cooling device, a container, a core having a broad flat upper face and having grooves therein, a pipe positioned around the core and engag'ng within the grooves to prevent displacement thereof, plates secured to the ends of the core and abutting the front and rear sides of the container, to



hold the core against longitudinal movement, one end of the pipe being horizontally extended through an end of the container, to hold the core in position, and sa'd end plates being extended upwardly to project above the coils and said horizontally extended end of the pipe to protect the coils and said pipe end.

1,234,882. **Speed-Governor.** William A. Doble, San Francisco, Cal., assignor to The Pelton Water Wheel Company, San Francisco, Cal., a corporation of California.

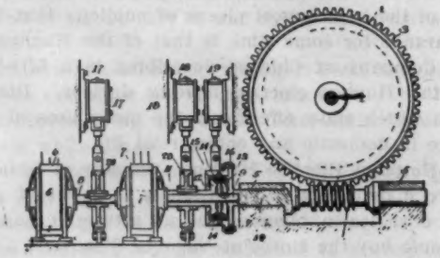
In a speed controlling mechanism, the combination of a controlling element, fluid pressure means for actuating said element, speed responsive means, a pilot valve actuated by



said speed responsive means, a member having a cam surface and arranged to be moved with said controlling element, and a valve actuated by said cam surface and cooperating with said pilot valve to control said fluid pressure means.

1,235,132. **Electrical Motive Apparatus.** Robert H. Gaylord, Pasadena, and Guy B. Capps, Los Angeles, Cal.

A driven element, two induction motors, braking means for the motors respectively, and means connecting said motors to the driven element whereby when the motors are operated at synchronous speed in the same direction as one another the driving element is driven and when one motor is held against rotating the other motor will be operated by the driven element at a greater speed than synchronous speed



so that said operating motor will produce dynamic braking action.

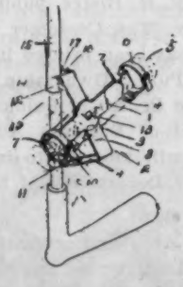
1,234,763. **Electrical Massage Apparatus.** Samuel W. Hills, Jerome, Idaho.

In an electrical massage apparatus, the combination of a casing, an electromagnet provided with a core, a substantially circular armature of soft metal in operative relation to, and having a diameter co-extensive with the diameter

of the core, a diaphragm comprising a pair of dove-tail shaped spring steel members carried upon diametrically opposide sides of the armature and arranged medially of and in the same plane with said armature, a closure for said casing, the outer edges of said diaphragm members being frictionally held between the casing and the closure, and a tool holder mounted upon said armature.

1,234,833. **Electric Lamp Support.** John W. Walter, Los Angeles, Cal.

A lamp support comprising a supporting member having means for holding a lamp, and an attaching member pivotally



connected with said suporting member, for angular adjustments, said attaching member being provided at one end with a right angular arm, said arm and the other end of said attaching member having engaging members for attaching said member to an object.

NEW ELECTRICAL DEVELOPMENTS

(A ruling to the effect that a Federal Land Bank may make a loan on lands in irrigation districts which have an outstanding bond issue, where the funds necessary to take care of the indebtedness are collected in the same manner as taxes, is the most important new electrical development of the past semi-monthly period. An increasingly brightened future is thus held out for electric power loads on projects of this nature. Other items of interest throughout the West may also be found in the following lines.—The Editor.)

FINANCIAL

VALLEJO, CAL.—The Pacific Gas & Electric Company will soon file a bond for $15,000 for the privilege of operating within this city.

IDAHO FALLS, IDAHO.—An election will be held here on September 18th for the purpose of voting on bonds in the sum of $35,000 with which to acquire an electric light and power plant.

SAN FRANCISCO, CAL.—President John B. Miller of the Southern California Edison Company has issued a statement denying that the company has applied for further issue of 21,174 shares of common stock.

SAN BERNARDINO, CAL.—That sentiment is strongly in favor of a bond issue to acquire the distributing systems of the Southern California Edison Company and the Southern Sierras Power Corporation will be the report of city officials at the council meeting. J. R. Mason & Co., irrigation district bond dealers have received the following letter from the attorney of the Federal Land Bank of Berkeley, which covers points of great importance:

Gentlemen: Replying to your letter of recent date, will say that this bank can make loans on lands in irrigation districts which have an outstanding bond issue, where the funds necessary to take care of the irrigation indebtedness are collected in the same manner as taxes. Of course, in making loans on such lands the amount of the outstanding bond indebtedness would be taken into consideration in determining the amount that would be loaned on such lands.

INCORPORATIONS

ELKO, NEV.—The Nevada Power Company has been incorporated here for $250,000.

TRANSMISSION

MARSHFIELD, ORE.—A survey is being made of the Golden Falls property with a view to converting it into a hydroelectric plant.

TACOMA, WASH.—The question of voting $3,000,000 with which to purchase Lake Cushman as a municipal power site will be voted upon next month.

REDDING, CAL.—The Pacific Gas & Electric Company has a force of seventy-five men at work at the intake on the big bend of the Pit River.

VENTURA, CAL.—Steps are being taken by the Southern California Edison Company for running of the high line proposed by that company from Castaic north of this city and through to Santa Barbara.

LOS ANGELES, CAL.—An order has been made by the board of supervisors directing chief mechanical engineer to complete plans and specifications and secure a building permit for the construction of a power house at the county hospital.

SAN DIEGO, CAL.—The San Diego Consolidated Gas and Electric Company plans to extend its electric power lines all through the county. The company is seeking a county franchise to save expense in advertising each time an extension is made.

OLYMPIA, WASH.—The bids opened by the State Board of Control for the construction of a power house at the state insane asylum, Sedro-Woolley, Wash., resulted in the Warrack Construction Company of Seattle, receiving the contract at a price of $24,200.

VISALIA, CAL.—All night fighting with over 300 men from the mountains, Visalia, Hanford and other localities, in an effort to save the Hammond plant of the Mount Whitney Power & Electric Company on the east fork of the Kaweah River, was reported to have been successful.

PORTLAND, ORE.—The engineers working on the interstate bridge have recommended that motor generator sets be installed, so as to make use of 11,000 volt lines to operate the bridge draw in case the voltage on the Portland Railway & Power Company line is pulled down. The generator sets would cost $5288, plus installation costs.

ELKO, NEV.—Elko Lamoille Power Company officials say during the past month its power line over the summit of the hills south of Elko has been practically demolished three times. Every pole on the line has been splintered by lightning, most of them so badly they had to be replaced, and many of the poles have been replaced two or three times.

ROCHESTER, NEV.—Joe Beane, superintendent of the Nevada Valleys Power Company, announces that the company is constructing a power line through Humboldt and Lander counties, to connect with the line at Rochester. A line will also be run to the various towns and valleys along the route. A line is to be extended to Golconda, and from there to Winnemucca and into Grass Valley.

LOS ANGELES, CAL.—The San Joaquin Light & Power Corporation has announced that a total of from 10 to 20 miles of new trunk lines for power will be constructed immediately in San Joaquin Valley, with a large number of laterals for the different ranches. The power company will also build a substation at Chowchilla, to cost at east $25,000. The total cost of the trunk lines is estimated at $201,000.

TRANSPORTATION

SANTA ANA, CAL.—It has been decided by the Pacific Electric Company to extend its Santa Ana-Tustin line to Irvine.

SALT LAKE CITY, UTAH.—The name of the Salt Lake and Ogden Railroad has been changed to the Bamberger Electric Railroad Company.

LINDSAY, CAL.—Lindsay is to get the Visalia Electric Railroad, according to the statement of R. G. Ballard, manager of the road, who was in the city closing up the deal for an option on the right of way tracts. Ballard stated that the last mile and a half, including road and right of way will cost the company about $65,000, or about double the amount which they expected to pay.

MARYSVILLE, CAL.—Through the efforts of the city council a mutual agreement has been reached between the Northern Electric Company, Yuba Manufacturing Company and the Southern Pacific Company relative to the removal of the former's tracks from Eighth and F streets in this city which connect with the Yuba Manufacturing plant here. The city has granted the Northern Electric Company a franchise to place its tracks on J street from Fifth to Ninth, where it will connect with the Southern Pacific line, giving them access to the Yuba Manufacturing Plant.

ILLUMINATION

SAN DIEGO, CAL.—A resolution of intention to establish the Loma Portal Lighting District has been adopted by the council.

FLAGSTAFF, ARIZ.—The Williams Electric Light & Water Company was practically burned to the ground, with a loss estimated at $8000.

VENTURA, CAL.—A resolution has been adopted by the board of trustees declaring intention to install ornamental street lighting on Main street.

SANTA BARBARA, CAL.—The public library has let contracts for the lighting equipment for the new library building to the Reynolds Electric Company.

OAKLAND, CAL.—An ordinance has been adopted by the city council for lighting posts and appliances to be installed for lighting of North Broadway.

EL CENTRO, CAL.—At a meeting of the city trustees it was suggested that a municipal lighting system be installed but this met with little favor because of the cost of installation.

WHITE SALMON, WASH.—An ordinance has been passed by the city council granting to the Pacific Power & Light Company, a franchise to run 50 years to operate in White Salmon.

DAVIS, CAL.—The town of Zamora, 14 miles north of Woodland, is to have electric lights if efforts of Supervisor Edson and Fred Shafter, secretary of the board of trade are successful.

LOS ANGELES, CAL.—Plans and specifications for improvement work in the Jefferson Lighting District have been adopted by the board of supervisors and the clerk has been directed to publish a notice inviting bids.

GOLDENDALE, WASH.—The Pacific Power & Light Company has filed with the board of county commissioners of Klickitat County, Washington, a petition asking for a franchise for a period of 50 years in Klickatat County.

LOS ANGELES, CAL.—Another step toward lighting Broadway was taken when the city council instructed the city attorney to prepare an order of intention to install the ornamental system advocated by the Broadway Improvement Association.

CARRIZOZO, N. M.—Street lights are now a certainty for Carrizozo. The mayor has been empowered to make arrangements with the Lincoln Light and Power Company for the installation of steel poles and proper lights to sufficiently light the town.

SAN FRANCISCO, CAL.—J. T. Mabey has filed with the superior court an opposition to the petition of the Halfmoon Bay Light and Power Company for permission to dissolve. He claims all the corporation's liabilities have not been met, as is alleged in the petition.

PROSSER, WASH.—At the last meeting of the city council the Prosser Power & Light Company presented a new 50-year franchise to be considered by the council as the franchise for lighting which the company is now operating under expires November 1, 1917.

HANFORD, CAL.—At a meeting of the board of supervisors a petition was filed in the office of the county clerk asking the formation of the assessment district to provide a lighting system for the town of Stratford, to be known as Stratford Lighting District of Kings County.

SAN MATEO, CAL.—The Pacific Gas & Electric Company has started 200 men installing electric lights numbering between 80,000 and 50,000 at Camp Fremont at Menlo Park. The contract which was secured by the company is one of the largest that has been let for electric power.

ARCATA, CAL.—The general manager of the Western States Electric Company states that preparations have been under way for some time past for making changes in light and power circuits in Arcata. Many of the changes will require new and larger poles and so extensive are they that it almost means the rebuilding of the entire system.

SAN BERNARDINO, CAL.—A committee has been appointed by the mayor to take charge of negotiations with power companies and to recommend the method by which appraisement may be made on the properties to further a municipal electric lighting project. The members of the city council declared at a meeting a few days ago that sentiment seemed to favor municipal lighting.

TELEPHONE AND TELEGRAPH

SUNNYSIDE, CAL.—The city council at its last meeting passed an ordinance granting to the City Telephone Company a franchise to do general telephone business in the town of Sunnyside.

MONTEBELLO, CAL.—The Union Oil Company of California has made an application to the board of trustees for the establishment of a telephone line here, and the company also asks for a permit to begin work on the building of the line immediately.

SACRAMENTO, CAL.—The Home Telephone Company of Los Angeles has applied to Commissioner of Corporations H. L. Carnahan for authority to distribute assets as dividends to holders of preferred and common stock; to settle the indebtedness of the company, and finally distribute the remaining assets.

IRRIGATION

STOCKTON, CAL.—Promoters of the Woodbridge irrigation district are busy preparing new petitions to the board of supervisors on account of the withdrawal of the petition filed about two weeks ago. The petition was withdrawn when it was learned that land included can be eliminated.

SUSANVILLE, CAL.—The contract for the construction work of the Baxter Creek irrigation district dam and canal was let by the board of directors to the Shattuck-Edinger Company of San Francisco. The commencement of the work will have to await the approval of the contractors by the state bond commission, and as soon as this has been received work will be commenced within ten days thereafter.

STOCKTON, CAL.—Drainage engineers from the department of agriculture and soil experts from the University of California are conducting a co-operative demonstration at the Frank A. Guernsey 260-acre ranch on Rough and Ready Island, just west of Stockton. They plan to determine cost data on the installment of an irrigation and drainage system in a typical delta farm and to demonstrate the practicability of such a system.

KLAMATH FALLS, ORE.—The new pumping plant for the Pine Grove Irrigation project has now been installed, and is expected to be in full operation by the first of next week. Six hundred acres are embraced in the district, which has recently been formed by 11 farmers of that section, who will pump the water from the south branch of the United States irrigation canal, near the ranch of S. E. Icenbice, through a half-mile ditch, now completed.

SAN DIEGO, CAL.—Plans for the development of two big water systems in this county and building of a power plant to furnish power for San Diego County and Imperial Valley, have been announced by Edward Fletcher Company. Incorporation papers have been filed for Warner Mutual Water Company, incorporated for $6,000,000 and the Pamo Mutual Water Company, for $4,750,000. Incorporators and directors of both companies are William G. Henshaw, Col. Edward Fletcher, W. E. Hodges, E. O. Faulkner and Wm. B. Gross. Warner Company will build a dam at Warner dam site and a power plant from which power will be furnished to a number of companies Pamo Company will build three dams, one at San Cemente site, at Linda Vista, one at Sutherland site at Ramona and one at Pamo site at San Pasqual Valley.